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FOUR DECADES OF NASAL ALLERGY

LYMAN RICHARDS, M.D.

BOSTON

In 1899 the eminent Holbrook Curtis,[1] confronted with a patient suffering from what was then called rhinedema, prescribed twenty-eight Sandow gymnastic exercises for him on rising and before eating dinner, and a walk of 10 blocks (presumably New York blocks) after breakfast and after luncheon, with an increase of a block a day up to an unspecified limit. Not content with this rigorous regimen, he further advocated a rectal sitz douche for the colon night and morning with 4 quarts of water. (An apparatus for this purpose once manufactured in Maine bore the euphonious title of the cascade enema bag.) All this treatment was said to be good for the portal circulation. In the light of the present extensive knowledge of allergic rhinitis and the increasingly rational treatment of it, modern physicians are inclined to smile at this homely prescription and tolerantly to condone its lack of scientific foundation and its inordinate demands on the patient's time. However, while the basic principles of nasal allergy were at that time little understood, it must be conceded that such wholesome physical exercise and colonic hygiene regularly carried out would undoubtedly be beneficial not only to the modern allergic patient but perhaps even to his physician. Continual rationing of gasoline may yet bring about an enforced return to the ambulatory features of Curtis' prescription.

Somewhat later rhinedema was conceived to be largely a nasal manifestation of a constitutional edema, as seen in such conditions as general anasarca, ascites and pulmonary edema. Hence came the effort to deplete the body fluids by purging and exercise. Already a differentiation had been made between this water logging and the swelling and congestion due to true infection. Seasonal hay fever and some evidence of sensitivity to animals were well known, but there had not yet dawned the realization, so common today, of the effects on the nasal mucosa of multiple sensitivity to a host of allergens, ingested and inhaled, which besets so many patients with nasal complaints.

In a comparison of such widely variant concepts as thus characterized the subject of allergic rhinitis, it has seemed to me that a brief survey of the *Transactions* of this Society over a period of forty years might give an interesting perspective of the progress which has been made by the efforts of many of my distinguished predecessors in this field. Periodically over the years significant steps have been made, some proving unsound and being shortly abandoned and others laying the foundations for further knowledge, but all contributing toward the slow clarification of a clinical problem which has proved, even today, to be one of the most perplexing and the most insoluble in the entire field of rhinology. As late as 1924 Mosher[2] listed nasal allergy as among the unsolved problems of otolaryngology. Chief among the stumbling blocks toward a solution have been a confusion of terminology and a lack of understanding of the underlying physiology and pathology of the disease. Rhinedema, rhinorrhea, nasal hydrorrhea and vasomotor rhinitis were all designed to convey the idea of nasal discharge and obstruction, but until 1913 the index of the *Transactions* contained no trace of the word allergy. Between 1921 and 1930 the word occurred in only four titles, but from 1931 to 1940 it shone forth in no less than eighteen references.

At the turn of the century certain persons were supposed to be victims of a uric acid diathesis—in more vulgar terms, the gout. Among these people were many suffering from rhinedema, or gouty nose, for which the popular therapy was administration of such drugs as sodium bicarbonate and mild mercurous chloride and elimination of many foods leading to accumulations of uric acid. Credence was lent to the theory of a gouty diathesis by cases of alternating asthma and gout, asthma and diarrhea, and asthma and rheumatism—all conditions thought to rest on an excessive retention of uric acid. Thus so early was attention focused

Read before the Eastern Section of the American Laryngological, Rhinological and Otological Society, Hartford, Conn., Jan. 15, 1943.

1. Curtis, H.: Rhinedema, Tr. Am. Laryng., Rhin. & Otol. Soc. **5**:93, 1899.

2. Mosher, H. P.: Unsolved Problems of Otolaryngology, Tr. Am. Laryng., Rhin. & Otol. Soc. **30**:354, 1924.

on the patient's dietary indiscretions. One writer of that day advocated in addition to systemic therapy a somewhat drastic "thorough scrubbing and scouring" of the nasal mucosa with phenol. Occasionally one sees results of nasal applications which are reminiscent of these practices of a bygone era.

In 1900 I read of the prescription of adrenal extract in what Berens designated as nasal hydrorrhea. Others advocated the use of this drug as a nasal powder to be blown onto the mucosal surface. This fact is of interest in view of the more recent enthusiasm for this same drug, some thirty years later, and is a reminder that many modern enthusiasms have been shared by predecessors long since forgotten. Its early use was conceived of as a measure to overcome a neurosis of the fifth nerve thought to be an etiologic factor in nasal congestion and discharge.

The first suggestion of underlying allergic sensitivity came in 1901, when Curtis, truly a pioneer in the study of nasal allergy, suggested the use in the treatment of hay fever of a fluid-extract of ragweed combined with aromatic oils, marketed in truly professional quantities as "liquor ambrosia." Testimonials, ethically solicited, were about evenly distributed between praise and condemnation, but one reads that the manufacturer planned a next year's output of fifty thousand bottles. One unfavorable reply reported the "ambrosia" as ineffective after a person had been horseback riding and another, hinting at the dust therapy now in ascendant popularity, said it was useless after one had been riding a bicycle over a dusty road. Despite its disappointing result this modern ambrosia represented a pioneering step toward the immunization which is now so fundamentally a part of modern allergic therapy.

In 1903 D. Braden Kyle [3] antedated much later efforts to study the character of the nasal secretions in hay fever, particularly with respect to their acidity and their alkalinity. He expressed the opinion that "with more attention to these secretions we would have less occasion to operate." Thus already surgical treatment of nasal diseases was proving disappointing as the answer to the allergic problem. Kyle's belief was that the nasal secretions liberated some irritating chemical substance into the air which induced the allergic reactions. His suggested therapy of ingestion of a teaspoon of sodium chloride to control an acute attack was many years later to be incorporated into further efforts to apply principles of biochemistry and acid-base metabolism in this problem—s without much sympathy from the biochemi themselves.

It was in 1905 that a wave of enthusia swept over rhinologists for use of the Dunb serum for the treatment of hay fever. T serum was produced by artificial inoculation horses with various pollens and was used eith by injection or as a powder applied locally the nose. It was put on trial by many observe with the variations in success which have alwa characterized any therapeutic innovation. Th it was far from the answer to the problem the unfortunate person who could not co fortably ride behind a horse is suggested in t somewhat impractical suggestion that if t horse were smeared with petrolatum the di culty would be solved. Perhaps today peop will soon be faced with the enforced return equine transportation to plague sensitive pe sons, and perhaps petrolatum will be so ration as to force them to some equally inconvenie method of solution.

With characteristic fluctuations the pendulu in 1907 swung toward consideration of nas allergy as a manifestation of sinus infection wi enthusiasm for zealous irrigations and insuffl tions, with the usual modicum of favorable r sults. Even today the concept that the patie may be allergic to his own infected mucosal su faces has by no means been settled and is st a subject of controversy among both allergis and rhinologists. On no single point have the been more divergent opinions than on the val or the uselessness of surgical treatment of t nose in the control of allergic disease. The e thusiasts for picturesque radical operations r port glowing success; the conservative dec surgical treatment and cite the many exampl of its failure which have subsequently fallen in their hands.

Still pursuing his enthusiasm for the bi chemical approach and still anticipating b twenty years a similar messianic fervor for th concept, Kyle [4] in 1912 studied the reactions salivary and nasal secretions and stressed th differentiation in their alkalinity after admini tration of sodium and potassium and ammonium A change from one reaction to the other b administration of a suitable drug was claime capable of abolishing sensitivity to grapefru or strawberries. The more detailed inquir into what were then termed chemic diseases the upper respiratory tract was revived twen years later and zealously applied as a guide t

3. Kyle, D. B.: Import of Salivary and Nasal Secretions in Hay Fever, Tr. Am. Laryng., Rhin. & Otol. Soc. 9:24, 1903.

4. Kyle, D. B.: Chronic Diseases of the Upp Respiratory Tract, Tr. Am. Laryng., Rhin. & Otol. So 18:324, 1912.

roper selection of food in the treatment of nasal llergy.

The first use of the term allergy as applied the nose came in the annals of this society 1913. The whole subject of anaphylaxis had en intensively pursued by immunologists since e epoch-making research of Theobald Smith in 03. These principles now began to be asso- ated with those manifestations of nasal dis- se which had heretofore been conceived of as such varied origin. The initiating event in is progressive step appears to have been the se in which a girl fell headfirst into a barrel flour and subsequently had chronic edematous initis and polypoid degeneration of the nasal ucosa. As yet there were no hints of the relief symptoms by the present well known methods desensitization.

Hard on this newer concept followed an terest by botanically minded rhinologists in e ever lengthening list of plants and flowers hich induced allergic symptoms in sensitive ersons, and early morning excursions were ade to gather various pollens with which to ake cutaneous tests. Skeptics of the theory specific sensitivity still suggested the likeli- ood of a neurotic element in such patients as neezed on smelling an artificial rose or on iewing a canvas of a crimson sunset over a ay field, but by 1923 the present accepted facts sensitivity to pollen were common knowledge, nd shortly to the lists of plants were added any common foods as important allergens. With the ready access one now has to prepared llergens of the pharmaceutic houses, one must dmire the zeal of those who rose early to sally orth and not only collected but laboriously pre- ared their own testing materials.

It was not long before this interest in spe- ific allergens led to an invitation to outstand- ng men in the field of immunology to appear efore the society and to elucidate these matters rom the viewpoint of the immunologists. Kol- ner,[5] with a clarity which cannot, I believe, be mproved on, defined hay fever and allied mani- estations of nasal sensitivity as "examples of naphylaxis in which subjects inherit an instabil- y of the vasomotor system which renders them ore susceptible to the effects of anaphylactic hock on smooth muscle of the blood vessels, esulting in acute congestion and edema as char- cteristic anaphylactic lesions. While the exact echanism is unknown, local or subcutaneous pplications of the exciting agent may result in omplete or partial recovery from the ana- phylactic state by the exhaustion of the anti- body." Thus was enunicated the fundamental principle of desensitization, so much a part of the present day therapy.

While fully aware of the soundness of these tenets laid down by acknowledged authorities, many rhinologists, confronted by a polyposis of the nasal mucosa and by sinus membranes grossly hypertrophied and exuding profuse pur- ulent secretion, still could not resist the belief that such pathologic changes called for radical extirpation of the diseased tissues, without con- sideration for any underlying allergy. Two opposing theories both had devoted adherents.

1. Sinus disease was caused by allergy as a result of repeated exposure to allergens, which thus rendered the affected membrane a ready prey to secondary infection.

2. Sinus disease, primarily infectious in origin, gave rise to bacterial allergens to which the patient responded with characteristic allergic symptoms. This view was given some credence because of the apparent cures which followed radical surgical extirpation of the diseased tis- sues. Alas that time has so often shown such spectacular improvement to be temporary and presumably due in a large degree to the surgical trauma attending even the most skilfully exe- cuted operations!

This wave of surgical enthusiasm has, since the fine exposition of Coates[6] in 1926, ebbed and flowed, with the present feeling in ascen- dancy that attention to secondary bacterial in- fection will prove in the long run unavailing unless due recognition is given to the underlying allergic involvement of the nasal mucosa. To what extent radical surgical procedures shall be employed in dealing with this secondary infection is still a fertile source of argument and a matter of personal opinion.

St. Louis until recently has had the reputa- tion for being a dusty city. It is interesting, therefore, that for the first time in 1927 and more recently with still greater insistence there has come from this city the first mention in the *Transactions* of dust as a potent allergen. Inter- esting also is the fact that simultaneously, and again from St. Louis, a guest allergist besought rhinologists to dust off their microscopes and to make careful studies of stained smears of the nasal secretions. The value of this procedure is now well known, and its practice is common- place with an increasing number of specialists; but even today it is neglected in the stress and the hurry of a busy practice, and only the re-

5. Kolmer, J. A.: Nature of Hay Fever and Bron- hial Asthma, Tr. Am. Laryng., Rhin. & Otol. Soc. **32**: 73, 1926.

6. Coates, G. M.: Rhinologic Aspects of Allergy, Tr. Am. Laryng., Rhin. & Otol. Soc. **32**:383, 1926.

peated insistence in the literature on its diagnostic importance will break down the resistance which this procedure still meets. The early designation of "many, few or occasional" eosinophils and neutrophils has given way to the modern and more complicated grouping of algebraic plus and minus signs, but increased attention to cytology has done much to aid in differentiation of the common cold from allergic rhinitis, and thereby to avoid needless surgical and inappropriate office treatment of nasal infections.

The microscope not only has proved of value in the cytologic study of nasal secretions but has furnished an increasingly broadening knowledge of the fundamental microscopic pathologic changes of nasal allergy. In 1927 Fink[7] presented as his candidate's thesis a masterly account of the changes in the tissue noted in nasal disease of allergic and vasomotor origin, with particular reference to the relationship between uncomplicated allergy and superimposed infection. Fifteen years later there is scarcely any important addition which has been made to this study, and the dependability of the findings and conclusions and their clinical application have never been challenged.

Beginning about 1932 there swept over certain parts of the country, largely by mail, a renewed interest in the influence of dietary factors in nasal allergy. For the rhinologist this interest was stimulated by the concept that in the color of the nasal mucosa lay the key to the nature of the patient's dietary errors and to the method for their correction. Patients were catalogued as alkaline or as acid ash ingesters and were forthwith presented with a list of foods of opposing acidity or alkalinity. Hydrochloric acid and sodium bicarbonate were revived after years of oblivion; citrus fruits were exchanged for meat, and bananas for bacon. Once again there was talk of the biochemical approach, and once again the pure biochemist and the physiologist were unsympathetic and at times openly critical. Nevertheless, there were numerous reports of clinical success in the application of this therapeutic approach, and in the face of failures with more accepted desensitizing procedures, it was an appealing and simple method of achieving results. It was unfortunately a therapy that admitted of no scientific control by anything approaching laboratory accuracy and stood or fell solely on the patient's statements, clinical observations and rhinologic enthusiasm. Beyond all question there lies behind this work a fundamental truth in attaching a significa to the relation between metabolism of the b and allergic manifestations, but before a depe able causal relationship can be established m scientific methods of investigation will have supplant the present uncontrolled and pu clinical ones.

Suddenly in 1935 there was appropria from the past a novel method of dealing w the nasal turgescence and discharge of alle and vasomotor rhinitis. Zinc ionization, merly utilized in treatment of chronic suppu tion of the middle ear, was reported to effective for relief of nasal allergy. A com cated source of electrical current, triple meta electrodes and an electrolyte of royal purple h at last gave the rhinologist his chance to t graduated dials, to deal in milliamperes and once to measure accurately his therapeutic ap cations. The method was forthwith taken both with enthusiasm and with skepticism, case reports began to come in from numer sources. Some of these found their way i the hands of manufacturers of the apparat and successful results were reported in gra tions, as finally scaled, of 5 per cent, though h one could evaluate a patient with hay fever 65 per cent rather than 70 per cent impro is difficult to understand. The fact that formulas of both the electrolyte and the el trode were kept secret induced some rhinolog to venture into the field of chemical analy and, as a result, to discover certain discrep cies that tended somewhat to suggest an elem of commercialism in this type of therapy. Mo over, there immediately began to appear repo of experimental work showing the effect of io ization on the histologic structure of the na mucous membranes, and the possibility of perm nent alterations which bade fair to be more d advantageous to the patient than was the origi allergy. Occasional reports of permanent an mia were not encouraging, and, although hi hopes were held for this therapeutic novel it has today, in general, fallen into disrepu After one brilliant cure of intractable hay fe in a personal friend and one experience in wh a patient was temporarily electrocuted, I ha discarded my own machine and, could I fi it, would be willing to turn it in for scrap.

In 1937 the use of adrenal extract was ag described as effective in treatment of na allergy, this time supported by the novel ad tion of small doses of insulin, a therapy wh again could not arouse any support or enthu asm from the physiologist but which, like th with hydrochloric acid, found a definitely fav able reception among many rhinologists wh

7. Fink, H. P.: Tissue Changes in the Nasal Mucosa, Tr. Am. Laryng., Rhin. & Otol. Soc. **33**:63, 1927.

inical results seemed to warrant concluding to be of value.

Through the waxing and waning of many of ese enthusiasms there has always been a tenncy for their proponents to pursue a straight d narrow path, unmoved by the pronouncements of their rival colleagues. The "diet angers" gave no heed in their writings to ionation; the "ionizers" disregarded immunization, d the "immunizers" took no stock in alkalinese balances.

Where then lies the truth, and is there, so far s nasal allergy is concerned, any answer to Pilate's age-old question?

During the past five years no one of the members of the American Laryngological, Rhinological and Otological Society has made more painstaking and tireless efforts to provide sound ethods of approach to the allergic problem than Hansel. He, more than any other individual, has id down a pattern of procedure devoid of transiory enthusiasm for this or that bizarre form of herapy which has no scientific basis. An understanding of the importance of a complete history, careful nasal examination, a painstaking and epeated cytologic study of the nasal secretions, n appreciation of the role of other manifestations f allergy and a therapeutic approach based on ll these gives the rhinologist at the moment a etter working background than he has heretore enjoyed. Special stress has been laid on e fallacy of the opinion that all nasal discharge indicative of infection and on the importance f differentiation between the recurrent comon cold and nasal allergy. As a result, unecessary and inappropriate nasal operations are rtunately being performed less and less often as preliminary study points the way to a more rational and intelligent understanding of the allergic problem.

To this problem there is probably no specific therapeutic answer. Numerous hopeful approaches have led only to blind alleys. From this survey it is amply apparent that the pioneers in rhinology have applied themselves with unstinted zeal to increase their knowledge of this subject and that they have long since tried and discarded many procedures and ideas which have since been revived as things newly discovered and original. Invaluable help has been afforded by the allergists and the immunologists who have shown that the rhinologic aspect of allergy is only one of its manifestations. In the solution of such a problem modern medicine more and more demands the collaboration of several groups of workers in special fields. To paraphrase a recent medical best seller,[8] for the solution of many perplexities still surrounding the subject of nasal allergy it is necessary today, as in the time of Nebuchadnezzar, to summon the magicians, the astrologers, the sorcerers and the Chaldeans from the immunologic laboratories, the diet kitchens, the departments of physiology and the botanic gardens in order that they all may perform their mysteries and work their incantations.

Even with their help and after forty years of rhinologic inquiry, the subject of nasal allergy still deserves at least partial inclusion among Mosher's unsolved problems.

319 Longwood Avenue.

8. Irving, F. C.: Safe Deliverance, Boston, Houghton Mifflin Company, 1942, p. 347.

SARCOID OF THE NOSE

LIEUTENANT COMMANDER RUSSELL FLETCHER (MC), U.S.N.R.

The purpose of this paper is to discuss briefly the subject of sarcoid and to report 4 cases of nasal disease in which biopsies showed noncaseating tubercles or sarcoid.

Sarcoid is so similar to tuberculosis in so many of its manifestations that many authorities believe that they are the same disease, although it has sufficient variations from typical tuberculosis to cause other authorities to disagree with them.

Pinner,[1] in an article in the *American Review of Tuberculosis* for June 1938, analyzed the literature to date and listed 217 references. He is a recognized authority and writer on the subject of tuberculosis and its pathology. He believes that tuberculosis and sarcoid are simply different manifestations of the same morbid process and that the cause of both is the tubercle bacillus. He feels that all the sarcoids should be called noncaseating tuberculosis, which should be understood not as a separate type of tuberculosis but rather as a phase of this disease and that, while usually chronic or stable, they may change into a caseating form. In this article he said:

> . . . there is no rigid dividing line between noncaseating and caseating phases. . . . The particular conditions that favor development and persistence of noncaseating lesions are insufficiently understood. . . . failure to react to tuberculin is commonly associated with the noncaseating phases of tuberculosis. Whether this anergy is cause or effect, whether it is dependent on the infecting strain, on constitutional or on immunologic peculiarities of the host, or on the modalities of the apparently chronic intermittent haematogenous dissemination, all these questions must wait for further studies to be solved.

Longcope[2] in October 1941 stated that from study of his patients, from bacteriologic examination of lymph nodes removed during life, from cultures made and from inoculation of tissue into guinea pigs, rabbits and pigeons he had not obtained any evidence to support the view that sarcoid is caused by human, bovine or avian tubercle bacilli. He also said that there was not the slightest clue as to any other cause of t disease. It is generally not considered to be r lated to lymphogranuloma venereum, syphil leprosy or rhinoscleroma, although some write have believed so.

As sarcoid occurs in a great variety of clinic forms, an extensive literature has accumulat in recent years. Boeck,[3] in 1899, was the fir to use the term "sarcoid." Typically, Boeck sarcoid included involvement of the skin, t mucous membranes and the lymph nodes. Gra ually new regions were found involved and giv the name of the observer, such as Jungling' disease, involving the bones, or Mikulicz' sy drome, involving the lacrimal and salivary gland Sometimes it was given the name of the anatom parts involved, such as uveoparotid fever, whi affects the uveal tract and the parotid gland.

Schaumann[5] showed that the lesions of t nose, the ears and the fingers described as lup pernio and the disease affecting the skin, t mucous membranes and the lymph nodes whi Boeck termed sarcoid are the same. There a many other combinations that have been name and described, but I believe it would be only co fusing to list them all. The main difference one of localization. The pathologic changes the disease are the same wherever the lesion located.

The uniformity of the histologic picture lesions of sarcoid in different parts of the bod is the most important evidence that all of thes lesions belong in one group. The unit of t microscopic picture is the epithelioid tubercl without caseation, or the so-called hard tubercl It consists of large pale-staining polygonal epithe lioid cells forming a mass about the size of miliary tubercle. The cells are not always co centrically arranged but may be fitted togethe

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Presented as a candidate's thesis to the American Laryngological, Rhinological and Otological Society, Inc., 1943.

1. Pinner, M.: Non-Caseating Tuberculosis, Am. Rev. Tuberc. **37**:690, 1938.

2. Longcope, W. T.: Sarcoidosis, or Besnier-Boeck-Schaumann Disease, J. A. M. A. **117**:1321 (Oct. 18) 1941.

3. Boeck, C.: Multiple Benign Sarcoid of Skin, Cutan. & Genito-Urin. Dis. **17**:543, 1899.

4. Jungling, O.: Ostitis tuberculosa multiplex cystic (eine eigenartige Form der Knochentuberculose), Fort schr. a. d. Geb. d. Röntgenstrahlen **27**:1, 1919-1920.

5. Schaumann, J.: Sur le lupus pernio: Memoir presente en Novembre 1914 a la Société française d dermatologie et de syphiligraphie pour le Prix Zambaco Etude sur le lupus pernio et ses rapports avec les sar coides et le tuberculose, Ann. de dermat. et syph. **6**:357 1916-1917.

e tiles in a floor. The clusters of cells appear naked, pale-staining, isolated islands, almost ways devoid of a peripheral inflammatory zone d without central necrosis. Sometimes, how- er, there is degeneration of the central cells. iant cells are not always present, but they are mmon. They are large and irregular, having any pale nuclei. The histologic picture on the hole is one of a proliferative rather than of an flammatory process.

Probably the most important characteristic at distinguishes a sarcoid from the usual tuber- losis is that the tubercles themselves appear to main stable and unchanged for long periods of me and do not usually tend to break down, ierate or caseate. However, it is known that some cases of sarcoid active tuberculosis de- lops. In the patient in case 1 (in this report) tive pulmonary tuberculosis developed, although e area in the nose where the sarcoid tissue was moved did not show any sign of recurrence of e condition after removal. In the other 3 cases e disease remained stationary. The patient in se 2 had specimens of identical tissue removed r biopsy from the nasal septum five years apart, d yet no perforation of the septum had resulted ore than ten years after she was first seen.

The solitary tubercles do not seem to grow in ze, but they sometimes increase in numbers and ay become so profuse that they form fairly rge, pearly gray, granular-appearing masses. hese were seen on the lower turbinates in cases and 4, and a small area of such tubercles was e first lesion observed on the inferior turbinate case 3.

The patients in cases 2 and 4 had small rophic turbinates, and, in fact, a progressive rophy was noted in both, although in case 4 the tient had been under observation only eighteen onths. There was no ozena in any of these ses. Crusts were observed in case 4, but these ere chiefly around the perforation of the sep- m, which had granular, unhealed margins.

None of the patients in the cases reported in is paper showed any constitutional symptoms reactions, such as fever, loss of weight, ano- xia, anemia or cough. The symptoms were imarily local and were not of a toxic or gen- al nature. In 3 of the cases an annoying nasal scharge was the patient's only complaint. The ndition in case 1 was discovered on routine icroscopic examination of the middle turbinate d ethmoid tissue removed during a radical ex- rnal frontoethmoid operation.

Multiple lesions in various parts of the body e commonly found, although none of the pa- ents in the cases here reported had lesions in other parts of the body than the chest. Roentgen examination of the chest in cases 2, 3 and 4 showed fibrosis and scarring of varying extent, but no activity. The patient in case 2 was under observation thirteen years and during all that time biopsies of nasal specimens revealed sarcoid. Although roentgen examinations showed the most scarring in the region of her chest, it was not progressive during those years.

Most persons with sarcoid have negative reactions to tuberculin, this fact being another reason for the divergent views among authorities as to whether sarcoid is tuberculosis or not. The reason for negative reactions to tuberculin tests, called anergy, is speculative. Tests with human, bovine and avian tuberculin gave positive results in 3 of the cases in this report. The patient in the fourth case was not tested, but sometime after his last observation pulmonary tuberculosis developed. It has been noted by several observers that patients with sarcoid in whom active tuberculosis developed lost their anergy to tuberculin, and their reactions to it became positive. Guinea pig tests were not made for these patients, as the biopsies were made when the disease was chronic, and the experience has been that positive results of such tests are rare and are obtained only when the lesion is a few days old.

According to the literature, there is no form of treatment of sarcoid that has been effective, not even ultraviolet rays, roentgen and electric desiccation or radium. This has been my experience as far as medical treatment is concerned. It would be useless for me to list all medicines that have been tried, but as the patient in case 3 has been under observation and treatment for seven years, every medicine, I believe, has been given a trial. The procedure in this case has included prolonged treatment with injections of tuberculin by a specialist in tuberculosis, two years of treatment by a dermatologist who has used solid carbon dioxide locally, injections of a bismuth compound, a rather intensive course of roentgen treatment and an intensive course of sulfathiazole therapy; yet there has been no real, permanent improvement.

I have tried electric desiccation rather frequently in case 4. At times the lesions, which are on both inferior turbinates as well as on the margins of the perforation of the septum, seem almost to disappear, but after eighteen months of treatment it surely cannot be considered that the patient is cured. Possibly a little deeper desiccation would be more effective.

However, surgical excision of the localized lesion produced a cure in cases 1 and 3 and may have been a contributing factor in the cure in

case 2. As this procedure has not been mentioned by other writers, a more detailed discussion of each case is warranted.

In case 1 a small and apparently localized sarcoid was removed from the ethmoid and turbinate region during a radical external frontoethmoid operation, which was done because of several flare-ups following an external frontal operation several years before. The lesion was found in the routine examination of the tissue removed, and its presence had not been suspected prior to this finding. The wound healed normally but slowly. Two years later the external incision, as well as the frontoethmoid region, was still healed, although active pulmonary tuberculosis had developed.

The patient in case 3 has been under observation for seven years and has had two different lesions in her nose. The first lesion was on the mucocutaneous junction of the septum. It was excised for biopsy, which showed sarcoid. The area healed within a short time and has remained healed and clear for five years. The second lesion developed some time later on the ala nasi and spread to the skin of the upper lip, but it has never spread to the site of the first lesion. The second area has never cleared up, in spite of intensive treatment.

The patient in case 2 had sarcoid tissue removed from both sides of the bony septum on several occasions in a period of five years. She disappeared from observation for the next five years, but ten years after the first biopsy was made all evidence of the disease had disappeared and there was no perforation of the septum. Of course, it is impossible to say how much the removal of this tissue had to do with final healing of the septum, for it is known that sometimes healing occurs spontaneously by the process of hyalinization and fibrosis.

The American literature reveals few cases of nasal sarcoid or of nasal tuberculosis with the diagnosis proved by biopsy. A large number of specialists in diseases of the ear, nose and throat, as well as specialists in diseases of the chest and tuberculosis, in California were asked whether they had ever seen a patient with nasal sarcoid or tuberculosis. Only three men told me they had ever observed such conditions. However, the patients in cases 3 and 4 of this report had previously been treated for many months by two or more otolaryngologists and no such diagnosis had been made. In case 3 I had not made a diagnosis of sarcoid until the woman had been under observation for several months. Undoubtedly there are a considerable number of these conditions that are not recognized. The purpose of this discussion and these case repo is to help others practicing this specialty recognize the disease in the nose.

REPORT OF CASES

CASE 1.—H. G., a white man aged 35, had had external frontal operation for acute frontal sinusi Later he had several flare-ups necessitating reopeni of the wound. Finally, after a severe flare-up, anoth operation was performed, and tissue was removed fr the ethmoid and turbinate region which showed typi noncaseating tubercles. The external wound healed, b the process was extremely slow. Later the patient we to Arizona because of pulmonary tuberculosis. He w seen two years later, and the nose was in good conditi externally and internally, with no evidence of recurren of sarcoid tissue.

CASE 2.—Miss R., a white woman aged 30, had simple mastoidectomy in 1929, and during a norma short convalescence she complained of nasal discharg Examination showed a small granular mass the size a pea on both sides of the nasal septum about 1 in (2.5 cm.) from the anterior tip. Microscopic examin tion of this tissue showed typical noncaseating tubercl Examinations of sputum failed to reveal tubercle bacil Roentgen examinations of the chest showed considerab scarring and calcification in the right lung and hil as well as in the cervical and axillary regions. Roentg examinations were repeated in three years and again ten years; they showed no essential change. Roentg studies of the bones showed no lesions. The patie had no constitutional symptoms. Reactions to tests wi human and with bovine tuberculin were strongly po tive, and the reaction to avian tuberculin was mild positive. In spite of repeated removal of this tissue a local medication, as well as ultraviolet ray therapy, t tissue showed the same microscopic picture after fi years. She was not seen again for five years, but the to my surprise, the nasal septum had completely heale and there was no perforation. There was, howeve granular tissue on the lower margin of the inferi turbinate which showed sarcoid. During the ten yea of observation there has been a definite atrophy of a the turbinates, but no crusts or ozena.

CASE 3.—Miss C., a white woman aged 40, had ha two separate lesions in her nose and had been und observation and treatment seven years. Her only com plaint was nasal discharge. This she had had for severa years in spite of treatment by several competent oto laryngologists. There was slight irritation in the le vestibule, and there were also two or three pinpoi nodules on the inferior turbinate. Roentgen studie showed that the sinuses were normal. I treated he locally for several months. She went to another sp cialist, who also treated her without relieving the irr tation and the discharge, although the surface looke better. On the septum at the mucocutaneous junctio there was a reddened indurated area nearly ¼ inc (0.6 cm.) in diameter. In spite of several months local treatment this lesion grew in size. A liberal piec was removed for biopsy, which showed the noncaseatin tubercle. This area healed within a short time and ha remained healed five years. In 1939, when the tests wit human, bovine and avian tuberculin were made, the irr tation in the vestibule flared up, and, although it ha quieted down at times, it has never completely cleare Reactions to the tuberculin tests were all positiv

ntgen examination of the chest showed scarring but activity. No lesions were found in the bones.
he had a complete course of tuberculin treatments a specialist in diseases of the chest. For more than years she has been under the care of a dermatolo-, who has treated her locally with solid carbon ide and other medicaments, with injections of a muth compound, with intensive roentgen irradiation with a course of sulfathiazole.
e spite of all this treatment the lesions on the ala remain essentially the same as they were three rs ago. But tissue removed for biopsy from the ocutaneous junction of the septum, which had been ised, has never shown any recurrence in the five rs of observation.

CASE 4.—Mrs. D., a white woman aged 38, had bleed- discharge and crusts from her nose for several rs. She had consulted several competent otolaryn- logists and was not improving. She had a fairly large foration of the septum with a rather granular red face and pinpoint nodules. There was also a granular, e piece of tissue on both inferior turbinates, which was removed for biopsy. This, together with tissue from the margins of the perforation, showed the microscopic picture of sarcoid. The size of the turbinates when first seen was almost normal, but in eighteen months I believe there has been a definite atrophy. Sometimes she has crusts, but these seem to be chiefly around the perforation. She has been treated with electric desiccation on small areas at a time. At times she seems to improve, but there has been no great change in the eighteen months of treatment, in spite of the desiccation and the other local treatment.

CONCLUSION

Sarcoid lesions of the nose are rare, but undoubtedly many are overlooked. Four cases are herewith reported. Treatment of sarcoid lesions has usually been considered ineffective. In 2 cases herein reported the lesion was excised surgically and did not recur.

490 Post Street.

p_H OF NASAL SECRETIONS IN SITU IN ATROPHIC RHINITIS

ITS IMPLICATIONS

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CHICAGO

A disease most resistant to effective treatment and presenting a problem of perplexing magnitude because its exact causation has never been determined is atrophic rhinitis. At no time can rhinologists be said to have erected a firm and completely logical foundation for specific treatment. Treatment in the main still consists in establishing cleanliness of the nasal cavity—for none of the so-called cures has stood the rigid and exacting test of time.

Perhaps part of the fault lies in the fact that the underlying pathologic changes in atrophic rhinitis have been little understood. Certainly, no one would attempt the use of astringents—as has been done in some quarters—if these changes had been taken into account. Perhaps some of the difficulty could be erased were investigators to direct a moderate degree of attention to an analytic study of the nasal discharge—those large, thick, tenacious crusts which adhere and mold themselves to the walls of the nasal cavity, which often produce nasal obstruction despite the presence of marked atrophy of the nasal mucous membrane and which are responsible for a most disagreeable odor, one varying in intensity and sometimes so strong that it is unpleasant to stay close to the unfortunate patient.

Special stress, it seems to me, should be placed by investigators not only on the histologic alterations in atrophic rhinitis but also on the abnormal nasal functioning produced by the disease. To a great extent these twin fields of basic endeavor provide the quintessence of rational and intelligent local nasal therapy. It is reasonable to assume that in the absence of knowledge on these points patients with atrophic rhinitis will continue to be treated in accordance with that growing list of medicaments which at various times has been proposed and discarded on an empiric basis.

Atrophic rhinitis is one of a number of disease entities in which the clinical eye is more capable of leading to an early satisfactory diagnosis than the microscope. This situation exi because the one important histologic cha characteristic of atrophic rhinitis during t early clinical stages is a chronic inflammato process, hardly a distinguishing feature. It only at the time that advanced microsco changes—essentially thickening and fibrosis the arteries—are seen that atrophic rhinitis c be diagnosed unequivocally.

The chronic inflammatory process is frequent identified by a definite tendency toward squamous cell type of epithelial metaplasia whi progresses along the surface of the mucous me brane as the pathologic process develops. Co sequently, nasal secretions which normally a kept moving by the action of cilia tend to adhe to the underlying mucous membrane. The bas ment membrane is thinned out, while the chara teristic small round cell infiltration, whi clusters about the glands, is found scatter throughout the connective tissue. Otherwise, t structures appear relatively normal, and t arteries and the veins give no evidence of pat ologic change.

During the late stages the epithelium dege erates and is frequently lost. Dense fibro tissue, not unlike scar tissue, lies directly benea the altered epithelium; this is the immedia explanation for the atrophic condition of t mucous membrane. At this time virtually all t arteries show evidence of thickening and fibros The intima and the media of the arterial wa often project fibrous buds into the lumens of t blood vessels and produce an obliterating ty of endarteritis. In advanced cases the bo undergoes fibrosis and degenerative change while the glands degenerate and are replaced undifferentiated fibrous tissue.

Much of the mystery concerning atroph rhinitis may be hidden in the changes in t blood vessels of the nose. These challenge scie tific curiosity and ingenious investigative activit conceivably, such an investigation may thro additional beacons of light on the proper choi of nasal medication.

PRESENT INVESTIGATION

Older methods of studying the hydrogen io concentration of nasal secretions in the pa

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volved the collection of samples of nasal secre-ns either by suction or by having the patient w his nose. Such procedures, while informa-e, possess distinct limitations, since the nasal cretions are not in situ, are divorced from the rmal milieu of the nose and are susceptible to mediate changes in reaction on exposure to . In the present study a silver–silver chloride ss electrode designed for study of the nasal ction was used in conjunction with the Cole-n electrometer. This method has been found overcome the limitations imposed by older ocedures.[1]

Some years ago Buhrmester[2] collected nasal cretions from 6 patients with atrophic rhinitis. total of eight p_H readings was taken. The lues reported ranged from 5.62 to 7.41. Four the eight readings fell within the acid range, r within the alkaline range. The technic ployed was not an in situ method.

In my own study 7 patients with advanced ophic rhinitis were observed. For the most rt each was studied only at a time when his se was filled with a considerable amount of sts. Minute to minute nasal p_H readings were ken for a period of forty-five minutes, and each ient was studied on three separate days. The ients were instructed not to employ any local al therapy during the period in which they re under observation. Only 1 patient, the th, was studied when the nose had been cleaned crusts.

A total of 21 individual experiments made the 7 patients with atrophic rhinitis at a e when crusts were present revealed that the al p_H varied from 6.81 to 8.43. The patient ose nose had first been cleaned of crusts had nasal p_H range from 6.35 to 6.68 (table 1).

COMMENT AND SUMMARY

The p_H of nasal secretion in situ in 7 patients ith advanced atrophic rhinitis shows a range om 6.81 to 8.43. The p_H level is higher than at recorded for the clinically normal nose (5.5 6.5). The patient studied when the nose as devoid of crusts had a nasal p_H range more arly approaching the normal.

The findings indicate that a group of patients ith advanced atrophic rhinitis present nasal cretions in situ which have a hydrogen ion ncentration deviating away from that of the clinically normal nose. The trend points to a state of altered nasal function in the patient with advanced atrophic rhinitis.

Elsewhere I have suggested that during acute rhinitis, acute rhinosinusitis and the more active stages of allergic rhinitis the employment of a nasal medicament which lowers the abnormal alkaline nasal reaction to a slightly acid one with p_H varying between 5.5 and 6.5 is most desirable. While the cases of advanced atrophic rhinitis presented in this series are few, the findings do suggest the thought of employing nasal medication to produce a normal, slightly acid reaction of the nasal secretion in atrophic rhinitis. In this connection it is well to remember the advice of Fantus,[3] who declared that a hydrogen ion concentration near that which is normal for the mucous membrane is of even greater importance for applications to the mucous membranes than is isotonicity.

p_H Values Found for Nasal Secretions of Patients with Atrophic Rhinitis

Patient	Nasal p_H Range
1	7.05 - 7.71 7.08 - 7.54 7.71 - 8.43
2	6.90 - 7.17 6.90 - 7.24 7.05 - 7.30
3	6.95 - 7.28 6.82 - 7.04 6.73 - 6.90
4	6.90 - 7.32 6.81 - 7.22 6.93 - 7.21
5	6.87 - 7.20 6.82 - 7.15 6.35 - 6.68 (nose cleaned of crusts)
6	7.12 - 7.49 6.92 - 7.36 6.97 - 7.31
7	6.86 - 7.19 7.01 - 7.23 6.97 - 7.26

It is hardly necessary to elaborate on the many medicaments—agents with varied p_H values ranging from acid to alkaline—at one time or another proposed and utilized in treatment for atrophic rhinitis. Each form of medication has been employed empirically; in each, scant attention, if any, has been paid to physiologic p_H values.

It is obvious that the employment of local medication properly adjusted to normal nasal p_H values will by itself fail to solve the distressing problem of advanced atrophic rhinitis. Too many intricate phases require further investigation before a conclusive solution is reached. Nevertheless, it is only through physiologic medication that one may currently hope to take a single step forward, small though that step may be.

185 North Wabash Avenue.

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RECONSTRUCTION OF THE DEFORMED NASAL SEPTUM

A CRITICAL EVALUATION OF THE ORTHODOX SUBMUCOUS RESECTION FROM AN ANATOMOPHYSIOLOGIC STANDPOINT

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The first treatise on a deviated septum causing nasal obstruction was written by Quellmaltz [1] in 1750. While symptoms and sequelae are well described, no mention is made of treatment. In 1839 Velpeau [2] in an indirect way quoted William of Salicet, who proposed the gradual dilation of the anterior part of the nares with a sponge to facilitate avulsion of nasal polypi. As late as 1889 Roberts [3] spoke favorably of punching out a piece of the septum at the point of deviation to permit breathing through both nostrils.

The last two decades of the nineteenth century witnessed the development of two great schools of thought in regard to the function of the nasal septum and the respect with which it is to be treated. The first school, of which Asch [4] was the foremost champion, preached that the cartilage of the septum should be preserved by destroying its resiliency and forcing it back into its proper place. The second school held that the septum is a mere partition and serves no physiologic function. On this premise Ingals [5] originated the operation of submucous resection of the quadrangular cartilage in 1882. Krieg [6] in 1886 extended the operation by including in the resection the vomer and the perpendicular plate of the ethmoid bone. This operation was further developed by Freer [7] and Yankauer [8] and finally perfected by Ballenger [9] with his invention of the swivel knife. It then became a free-for because of the ease of the operation. In hand of the master, Asch, good results were tained with his operation of crucial incisions the forcible bending of the bases of the result triangles by Steel's forceps. Satisfactory res were obtained with Sluder's [10a] operation. method consists in the making of three para longitudinal incisions through the mucous m brane and cartilage on the side of the convex and the pushing over of the upper piece cartilage so that it overrides the lower, in or to overcome the resiliency of the three pie Gleason's [10b] u-shaped flap operation had advocates. While the submucous operation hailed as the great modernizing step in n surgery, nevertheless it was soon realized many failures and a few disasters were enco tered.

That perfection was not attained by the op tion of submucous resection is evidenced by fact that Löwe [11] created a sensation in 1905 his operation of decortication of the face. method consisted of making an incision thro the gingival-buccal fold of the upper lip, exte ing from the first molar on the one side to t of the other, and clear to the bone; the parts were then separated from the bone u the under border of the piriform fossa was view. The inferior and anterior borders of cartilaginous septum were then denuded of soft parts by means of shallow longitudinal cisions along the anterior nasal spine. mucous membrane was not perforated, as whole operation was extranasal. A raspato

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Presented before the Section on Otolaryngology of the College of Physicians and the Philadelphia Laryngological Society, Dec. 15, 1943.

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t on the flat, was then inserted beneath the erior turbinate and from that point the lateral al wall, the nasal floor and the septum were lermined. The nasal floor was invariably t loosened so as to avoid tearing of the cous tube. After elevation of the mucous mbrane, the anterior parts of the quadrangu- cartilage were exposed. Deformities in the erior segment of the septum could then be noved. This essentially constitutes an im- rtant step of the modern conception of recon- uctive surgery, namely, the wide mobilization the external nose.

INCIDENCE OF SEPTAL DEFORMITY

The incidence of septal deformity is wide- read. Dunning [12] found deviated septums in per cent of patients who entered New York spitals for various ailments. Mackenzie [13] dis- vered asymmetry of the nasal fossae in nearly per cent of 2,000 Caucasian skulls examined. owever, it is well recognized that the great ma- rity of septal deformities do not interfere with rmal nasal function. Every rhinologist has d occasion to observe a patient with a marked ptal deflection which caused no disturbance hatever. Douglass [14] found that only 11 to 12 r cent of septal deflections caused symptoms cessitating surgical intervention.

In the experience of the otolaryngologists at mple University the percentage was even wer. Of 200 unselected consecutive patients o have consulted us as rhinologists because various nasal complaints, only 9 required rgical treatment of the septum. For 6 of these e orthodox submucous resection was done, and the remaining 3 nasal reconstructive pro- dures were incorporated.

ANALYSIS OF FAILURES OF CORRECTION

The submucous resection is admittedly a sur- al procedure of great significance and has a finite place in intranasal surgery. For ample: When the septum is found pressing on e lateral nasal wall, interfering with the drain- e of an infected ethmoid labyrinth or a frontal nus, it is generally admitted that the encroach- g portion of the septum must be resected. milarly, when an exostosis of the septum be- mes an irritant of the sphenopalatine ganglion pressing on the posterior tip of the middle turbinate, as described by Eagle,[15] the operation is limited to a partial resection. And further, when only the osseous portion of the septum is involved, the orthodox submucous resection is the ideal operation. It is not a panacea, however, and rhinologists using it have met with many failures in attempting to bring about normal physiologic nasal function, so that it has fallen into disrepute not only with the general practitioner but particularly with the laity.

In a critical analysis of the postoperative results of several hundred submucous resections certain practical deductions seem inescapable:

(*a*) Whenever there had been bony distortion of the septum involving either the perpendicular plate of the ethmoid bone or the vomer or both, there was universal improvement symptomatically and physiologically.

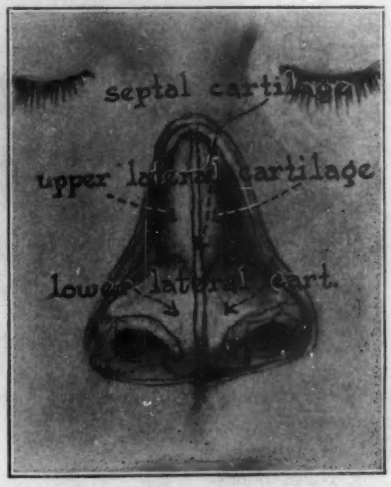

Fig. 1.—Fusion of the upper lateral cartilages with the septal cartilage.

(*b*) Normally, the septum is a rigid mucomembranocartilaginous and osseous structure dividing the nose into two. In a number of instances it was noted that instead of the septum being rigid, it was flaccid, and the flaccid septum changed position with inspiration and expiration, thus creating eddies. It follows, therefore, that wherever there are eddies the air currents are not properly disseminated nor is the air conditioned adequately. Therefore physiologically as well as clinically there was no improvement.

(*c*) Whenever the cartilaginous and osseous portions were involved, improvement was limited.

(*d*) Whenever the cartilaginous part of the septum alone was involved, the end results of the submucous resection were generally unsatisfactory.

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14. Douglass, B., cited by Winslow, J. R.: Laryngo- ope **16**:762, 1906.

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REASONS FOR FAILURE AND MEANS OF AVOIDING THEM

Rhinologists are witnessing the evolution of a new school of thought, which holds that the submucous resection is not limited to the septum alone but is rather one step in a procedure of reconstruction in which the nose in its entirety is taken into consideration.

For academic purposes I present an anatomic outline by which to classify deviated septums in their relationship to other nasal deformities.

1. Deformities limited to the septum:
   - (*a*) Osseous septum { Ethmoid bone; Vomer; Maxillary spine
   - (*b*) Cartilaginous septum { Quadrangular cartilage; Vomeronasal cartilage
   - (*c*) Columellar septum—mesial crura

"plastic surgeons," to invade the specialty. T situation is by no means hopeless, but the ne sity for reform cannot be overemphasized.

To recapitulate:

1. When the septal deformity is limited to osseous portion of the septum, the end result a submucous resection are universally good.

2. When the septal deformity involves b the osseous and the cartilaginous portion, results vary.

3. When the septal deformity is limited to quadrangular cartilage, the end results of submucous resection are indefinite.

UPPER CARTILAGINOUS VAULT

Since the incidence of septal deformity is wi spread and septal resection alone will not alw

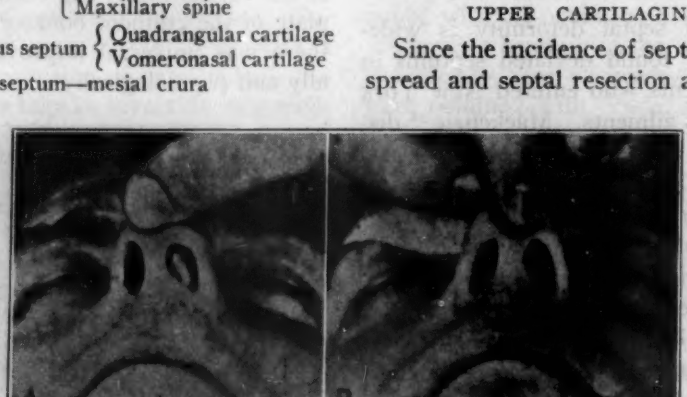

Fig. 2.—*A*, dislocated columna cartilage; *B*, postoperative appearance.

2. Septal deformities with involvement of contiguous structures:
   - (*a*) Osseous vault
     1. Nasal bones
     2. Frontal process of maxilla
   - (*b*) Upper lateral cartilaginous vault
   - (*c*) Lower lateral cartilaginous vault (lateral crura)

I shall, however, base the discussion on clinical observations rather than on academic conceptions.

Many septal deviations are associated with external deformities, and rarely does one encounter a nasal disfigurement in which the septum is not involved. The causes of nasal deformities are principally congenital malformation, heredity, disease and trauma.

Rhinologists have been particularly lax in their approach to the correction of external deformities. They have ignored the fact that when an external deformity exists in conjunction with a deviated septum, it is their responsibility to correct both. As a rule they perform the submucous resection but hesitate to correct the external deformity. This has permitted the cosmetician to enter the profession and has allowed many quasirhinologists, who style themselves

bring about satisfactory results, the rhinologist confronted with the question: Why? My answ to this vital question is that the upper late cartilages may not have been taken into co sideration when the submucous resection w performed. By way of further elucidation, me say, for example, that for the purpose establishing unimpeded respiration and prop ventilation, the correction of nasal obstructi must embrace not only the deflected septum b also the associated deformities of the exter nose which may involve the nasal bones, t frontal process of the superior maxilla and t lesser and greater nasal cartilages. The upp lateral cartilages are fused with the septal ca tilage and are in reality embryologically a anatomically an integral part of the septum (1). The muscular aponeurosis of the exter nose, consisting of the transverse part of t nasalis and the procerus muscle, lends tensen and gives a springlike effect to the septum to ho it firmly in the midline anchored in the rid of the palate. However, when the nose receiv a blow of excessive force and the septum sustai a fracture of suture line with angulation (ridg or, what is worse, a dislocation of the anteri cartilage, and the condition is allowed to rema

treated for a considerable length of time, a pro- nd change takes place in the mechanical ancing of the upper lateral cartilages. The ringlike effect shifts to one side and the tense- s of the aponeurosis holds it firmly in that ection. It follows, therefore, that the success a nasal operation (whether for deflection or dislocation of the quadrangular cartilage) ends a great deal on the upper lateral car- ges, on whether they do not affect the septum exerting too much of a springlike pull to one e.

Successful reconstructions of the deformed al septum have been devised by MacKenty,[16] tzenbaum,[17] White,[18] Peer[19] and Fomon.[20] In the past decade the septal cartilage was en completely removed, resulting in drooping

Fig. 3.—Drooping of the nasal tip as a result of plete removal of the quadrangular cartilage.

the nasal tip and retraction of the columella. e operation for the purpose of establishing an way from the naris to the choana was thus un- cessful. The mechanical reason for failure here was that the nasal tip became dependent and interfered with nasal respiration. The caudal end of the nose drooped, thus obstructing respiratory function (fig. 3).

On the other hand, submucous resections have been performed with preservation of the quadrangular cartilage, and despite the fact that all the mechanical and technical steps were carried out meticulously, with a resulting straight membranocartilaginous septum, the operation has been a failure. Again the query: Why? And again the answer is that the upper lateral cartilages, which act as guy ropes, interfere with the lumen and with the volume and the velocity of the air intake. And, although there is a straight septal line, the guy ropes of the upper lateral cartilages obliterate the space by reason of their encroachment on the cartilaginous septum (fig. 4).

When the upper lateral cartilages are long, as in the leptorhine nose, a submucous resection is not beneficial because the cartilaginous septum is bound to the upper lateral cartilages and the respiratory changes are impeded by the guy rope effect of these cartilages (fig. 5 *A*). It necessarily follows that success of the submucous resection (whether performed when there is septal deflection or when the septal line is straight) depends greatly on the reposition of the upper lateral cartilages. In many instances the mere detachment of the upper lateral cartilages would have been sufficient to release the guy rope traction, and submucous resection could have been avoided.

Drooped nasal tip, narrowed nostrils, retrusion, saddle nose and distorted external nose are deformities which formerly belonged in the realm of plastic surgery. They must now receive consideration by the rhinologist in his endeavor to reestablish nasal function by reconstructive surgery, particularly when they are concomitant with a deviated intranasal septum.

At one time it was believed that a saddle nose which followed a submucous resection was due to the complete removal of the septum; rhinologists could not understand why entirely apart from syphilitic or traumatic factors saddle noses developed in some patients and not in others. Today they can give the reason for this deformity. This result is found in cases in which the upper lateral cartilages are short in their relationship to the quadrangular cartilage and the shortness of the upper lateral cartilages rather than the complete removal of the ventral end of the septal cartilage is responsible. If the upper lateral cartilages are short, as in the platyrrhine nose, and a submucous resection is indicated, the upper lateral

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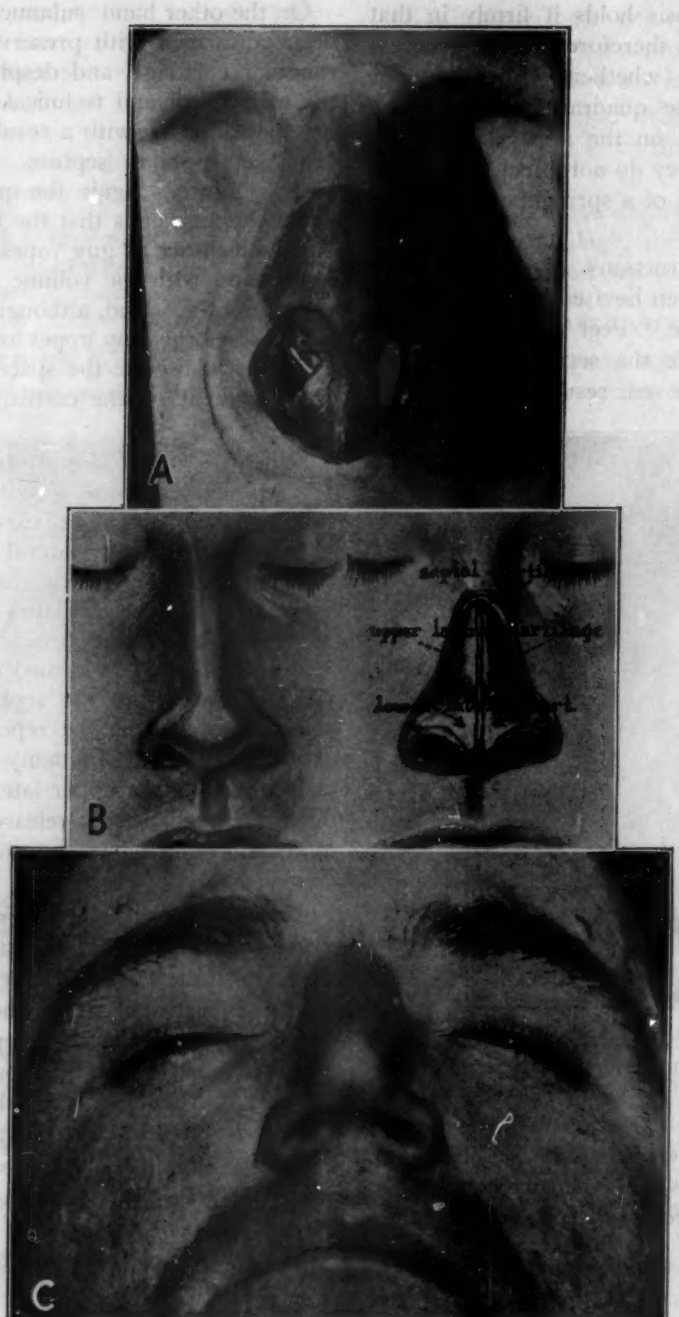

Fig. 4.—*A*, guy rope effect of the upper lateral cartilages. The lower lateral cartilages have been partially resected, permitting a view of the upper lateral cartilages and their attachment to the septum. *B*, drawings show attachment of the upper lateral cartilages to the septum creating traction and narrowing of the nares. *C*, traction of the upper lateral cartilages causing narrowing of the naris. Submucous resection did not improve respiration. The upper lateral cartilages should have been detached from the septum.

ilages must be detached and sewed over the sum of the nose so as to prevent a saddle de- nity (fig. 5*B*). Should the nose still be de- ssed after the upper lateral cartilages have n sewed over the dorsum nasi, it becomes

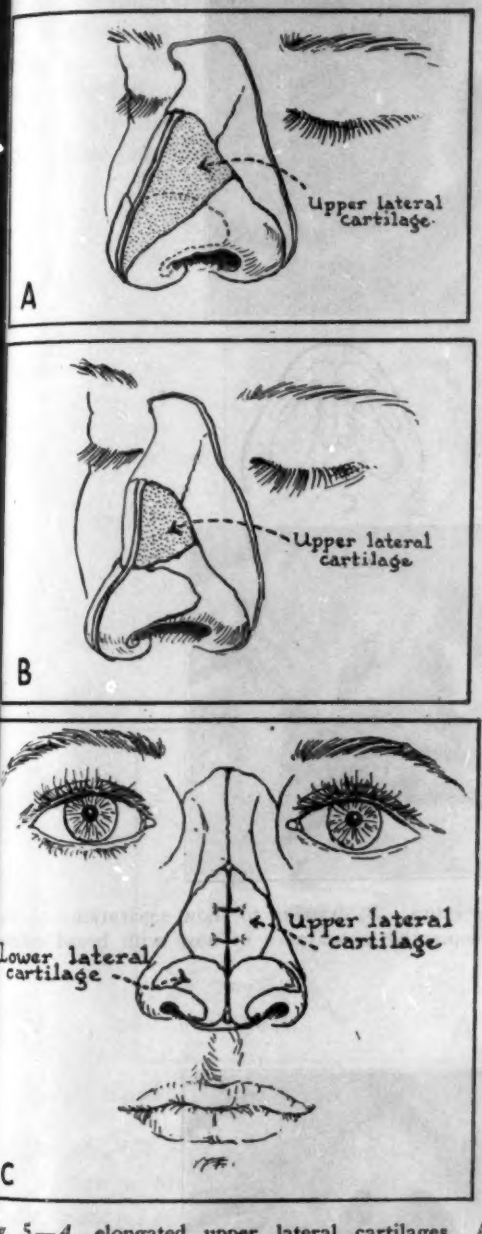

Fig. 5.—*A*, elongated upper lateral cartilages. A dle or a concavity will never develop in this type of e even though the septal cartilage is completely oved. *B*, short upper lateral cartilages. If the er lateral cartilages are short, there is always the ger that a saddle nose will result from a submucous ection. *C*, sewing of the upper lateral cartilages over dorsum nasi.

cessary to take the cartilage which was re- oved from the septum and implant it over e sewed lateral cartilages in order to fill the ncavity (fig. 5*C*).

If the upper lateral cartilages are long and their attachment extends forward and toward the caudal end of the septum, a saddle or a concavity in its ventral portion will never develop even though the septal cartilage is completely removed (fig. 5*A*).

Other reasons for failure in surgical treatment of the deformed septum may properly include the condition of a wide or broad columella, which may be due to a separation of the mesial crura or to thickened underlying tissue (fig. 6*A* and *B*). This must be narrowed at the time of the submucous resection, and this can be accomplished by removing the excessive tissue or by approximating the two mesial crura with sutures (fig. 6 *C* and *D*).

There are also cases in which a protruding nasal spine may press the lip forward and widen the lower portion of the columella, thus reducing the space in the vestibule and interfering with respiration. This too should be corrected at the time of the submucous resection, and the result can be accomplished by shaving the nasal spine or removing it completely with mallet and chisel. Parenthetically, this also permits correction of an ugly deformity of the upper lip (fig. 7).

Not infrequently a buckled septal cartilage produces an external nasal deformity involving the upper or the lower cartilaginous vault or both. Under such circumstances the septum is straightened by removing one or more buckles subperichondrially, with the resultant disappearance of the external deformity. In cases in which the entire septal cartilage has necessarily been sacrificed, drooping of the tip from the lack of support can usually be avoided by attaching the columella to the upper lateral cartilages with a hammock suture. Should the upper lateral cartilage fail to furnish this support, a strut made from the resected septal cartilage may be inserted between the mesial crura (fig. 8).

LOWER CARTILAGINOUS VAULT

A distortion or deformity of the lower cartilaginous vault involving the lower lateral cartilages or the nasal tip or both in conjunction with deviation of the septum contributes to nasal obstruction and requires surgical treatment and adjustment. For example: A collapsed lower ala interferes with respiration; an abnormally concave lower lateral cartilage obstructs the naris; a broad or an abnormally narrow nasal tip may also contribute to faulty respiration. In these cases it is obvious that submucous resection alone cannot improve the airway or restore respiratory function unless the lower cartilaginous vault is also corrected.

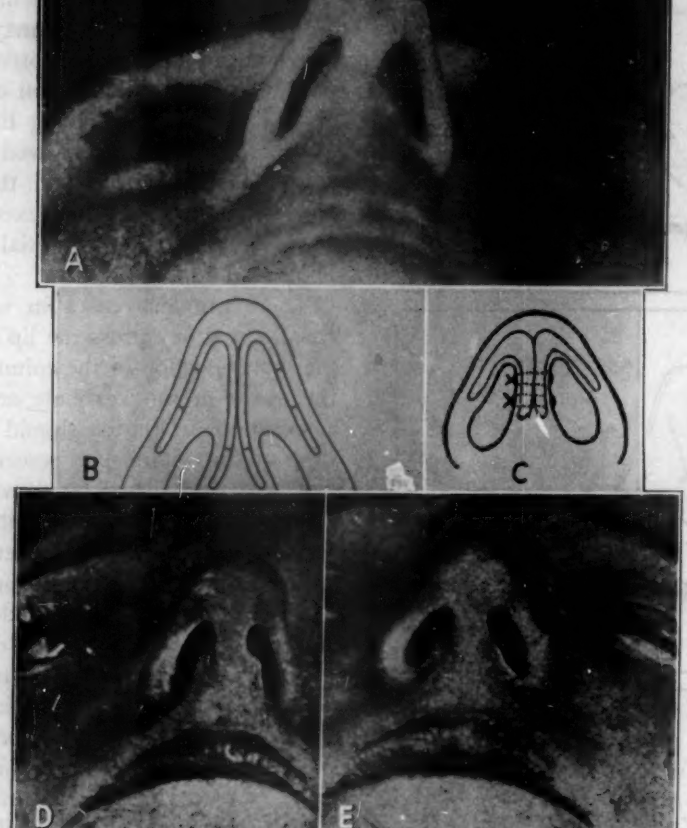

Fig. 6.—*A*, broad columella with separation of the mesial crura. *B*, drawing to show separation. *C*, sew of the mesial crura so as to narrow the columella. *D*, preoperative appearance of nose with broad colum *E*, postoperative appearance of the nose shown in *D*.

Fig. 7.—*A*, note the protruding nasal spine which presses the lip forward and widens the lower por of the columella. *B*, postoperative appearance.

Since in many cases septal deviation is associ-
d with external nasal disfigurement, a ques-
naturally arises as to which operation should
performed first. To rhinologists this offers
problem. When the septal deformity lies in
nt of an imaginary line from the nasal spine
the frontal bone to the spine of the maxilla,
nologists correct the septum and external
al pyramid through the transfixion incision
g. 9*A*). In cases in which the deformity lies
sal to this imaginary line, it is a matter of

bones and by immobilizing the cartilaginous portion of the septum, the perpendicular plate of the ethmoid bone and the vomer. 7. It permits successful anatomic reconstruction. 8. It assures better physiologic respiratory function of the nose.

CONCLUSIONS

1. External nasal deformities must be given consideration by the rhinologist in his endeavor to reestablish nasal function by reconstructive surgery.

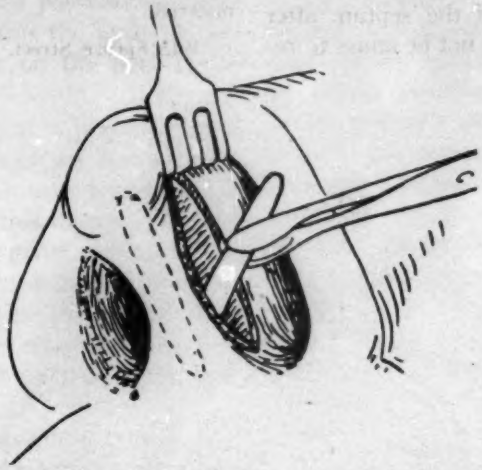

Fig. 8.—Insertion of a cartilaginous strut into the columella.

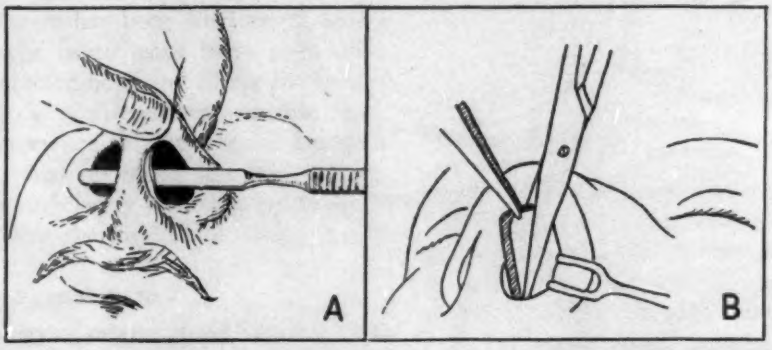

Fig. 9.—*A*, transfixion of the septum. *B*, shortening of the septum through the transfixion approach.

sonal choice whether the submucous resection
done before or after reconstruction.

The advantages of the transfixion approach are
follows: 1. A submucous resection can be
mplished with ease and under direct vision.
One may shorten the septum when indicated
g. 9*B*). 3. The nasal spine may be partially
ved or completely removed in the event that it
duces a protruding lip. 4. It may also be help-
if the lower part of the septum protrudes into
columella; 5. It allows for the narrowing of
columella. 6. Through this approach any de-
mity of the osseous dorsum can be corrected
removing the ventral portion of the nasal

2. Although submucous resection is a modern step in intranasal surgical procedure, it is only one of the phases in nasal reconstruction. However, it does not necessarily follow that all submucous resections require surgical treatment of the external nose, or vice versa.

3. The importance of adjusting the elongated upper lateral cartilages to the septal cartilage in order to establish proper respiration cannot be overemphasized.

4. The necessity of restoring, transplanting and shortening elongated upper lateral cartilages in order to change the guy rope effect on the septum must not be overlooked or ignored.

5. If the upper lateral cartilages are short, one must carefully anticipate the possibility of a potential saddle nose when performing a submucous resection. An should the deflection be situated ventrally, necessitating removal, the upper lateral cartilages might well be detached and sewed over the ventral portion of the nose.

6. If a saddle nose is present preoperatively, the septal cartilage which is removed during submucous resection should be utilized and transplanted in order to correct the concavity.

7. To prevent flaccidity of the septum after submucous resection, it would not be amiss to replace a segment of the resected septum betw the flaps of the mucous membrane; this will rigidity to the septum and thus minimize osc tions and eddies.

8. The advantages of the transfixion appro over the orthodox method of correction of the formed nasal septum should be taken into sideration.

Dr. Maurice Saltzman assisted in the prepara of the bibliography. Drs. Reuben Kayser, Frank T chik and the Fomon Group helped with the photogra material.

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OSTEOMYELITIS OF THE FRONTAL BONE

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Osteomyelitis of the frontal bone presents ficulties in early diagnosis, taxes the surgeon's sourcefulness in making the decision to operate, ghtens the patient with the possibilities of the sulting deformity and forms the basis for un-ited worry and anxiety on the part of the ient's family.

This article is a résumé of a personal series 10 cases of osteomyelitis of the frontal bone, vering four years, in which were found most of usual complications of this disease. Instead details on each case being given, statements are neralized to the subject, with references to cific cases and photographs. All patients have en photographed at some stage after the pri-ary operation, and some patients have been otographed at all stages.

In addition to the preoperative clinical and ntgen evidence of osteomyelitis, the diagnosis each case was substantiated at operation by finding of macroscopic necrosis of the bone.

A major question has been whether to suture incisions tight or to leave them open after moving the infected bone and filling the result-g space with a powdered sulfonamide com-und. My experience in suturing the incisions ht at the original operation has been scanty, t it has been sufficiently discouraging to make open treatment the method of choice at this me.

DEFINITION

The terminology of osteomyelitis of the frontal ne as used in this article will indicate an actual tive bacterial infection invading the frontal bone tside the confines of the frontal sinus.

CAUSES

1. Acute frontal sinusitis is the cause of osteo-yelitis of the frontal bone in the great majority cases.

2. Chronic frontal sinusitis is rarely causative nless it figures as the basis for an acute exacer-ation), because during the course of the chronic fection the frontal bone tends to form its own rrier to the spread of the infection.

3. Trauma to the frontal bone may be the cause of osteomyelitis and may have the following sources:

(*a*) Operation. When osteomyelitis of the frontal bone results, the operation usually follows the external approach for acute frontal sinusitis, at which procedure the mucous membrane is either partially or completely removed. Occasionally the disease may follow the external operation for chronic frontal sinusitis. This is a principal reason for preferring the intranasal route for the treatment of purulent sinusitis when this method is possible.[1]

(*b*) Injury. Compound fracture of the plates of the frontal sinus or of the frontal bone beyond the confines of the frontal sinus may lead to osteomyelitis. The danger is somewhat increased when the fracture is comminuted.

4. A possibility of blood-borne infection from a part of the body remote from the head may be mentioned. Such an infection did not occur in the cases described in this article.

WHAT HAPPENS

1. The mucous membrane of the frontal sinus becomes infected.

2. The blood vessels from the mucous membrane into the bone fill with septic thrombi.

3. The blood vessels of the diploe connecting the frontal sinus with the blood lakes of the frontal bone, which are located close to the coronal suture, become filled with septic thrombi.

4. The section of the bone involved dies, decalcifies and sequestrates. Both tables are affected. Usually the inner table fares worse, and it is from this point that the more serious complications have their origin.

5. In the event the disease follows injury the infection may directly enter the bone, being not at all concerned with the mucous membrane of the frontal sinus.

DIAGNOSIS

History.—This may be of importance if it is referable to a recent or present infection of the upper respiratory tract, especially when the symp-

Read before the Southern Section of the American ryngological, Rhinological and Otological Society, , Chattanooga, Tenn., Jan. 28, 1943.

1. Brown, L. A.: Intrasinal Application of Sulfonamide Powder, Ann. Otol., Rhin. & Laryng. **51**:611-614 (Sept.) 1942.

toms are suggestive of frontal sinusitis. Occasionally the patient may give a concise history of chronic sinusitis with pus, in which case often there has been conservative and surgical treatment. A history of one time trauma to the head frequently is revealed and infrequently is important. Osteomyelitis which results from injury usually follows closely on the injury.

Signs and Symptoms.—The symptom of which the patients most frequently complain is headache. This may vary in intensity from mild discomfort to excruciating pain. Although the headache is commonly frontal or vertical, it may be occipital, but occipital headache leads one to suspect a complication such as dural involvement. Chills and high fever are not the rule. A temperature of 98 to 101 F. is more constant. Nasal stuffiness and profuse nasal discharge are not major complaints, probably because of symptoms of greater moment. There may be a fair amount of purulent nasal discharge, but nasal congestion is not pronounced. As the disease progresses and complications occur, there may develop one or more of the following signs and symptoms: intolerable headache; subperiosteal fluctuation; varied degrees of nuchal rigidity; mild delirium; choked disks; semicoma, even complete coma; occasionally, sudden death.

Clinical Examination.—The most suspicious finding is a doughy subperiosteal swelling of one side or both sides of the forehead, extending from the brow toward the hair line, the height of the swelling being directly proportional to the osseous involvement. There is tenderness over the involved sinus or over the entire forehead. Intranasal inspection generally reveals pus escaping from the anterior end of the middle meatus on the affected side. The involved sinus does not transilluminate normally clear. Occasionally one sees acute frontal sinusitis with edema of the skin over the sinus but not extending to the hair line. This is a source of worry to the surgeon, but it is not sufficient evidence by itself to warrant the radical treatment for osteomyelitis of the frontal bone.

Laboratory Findings.—The blood count varies only in the number of leukocytes, the total of which rarely exceeds 15,000. In the differential count the percentage of polymorphonuclear leukocytes is not strikingly high, sometimes reaching 80 per cent but rarely being higher unless there is a complicating factor. There are no significant urinary changes. The spinal fluid is normal, prior to certain complications.

Roentgen Examination.—Much dependence is put on the roentgenologic findings. As in a roentgen examination of other parts of the body, a poor film had best be entirely disregarded, but correct films have definite value. The lat aspect is of little importance; however, a vie the nose-forehead position and stereoscopic fi in the nose-chin position may provide the ne sary information. Nevertheless, the interpr tion of the roentgenograms must be associa with the clinical signs. If the disease has p gressed to the stage of sequestration, roent diagnosis is relatively easy (fig. 1); however, patient is usually seen much earlier. The ch acteristic roentgen symptom is decalcificati This condition cannot be definitely determi in the anterior and posterior bony plates the frontal sinus, although probably it is th but it is early seen at the junction of these t that is, at the superior limit of the frontal sin This "white line" becomes less distinct and fin fades out, in contrast to the "white line" of opposite frontal sinus. On the other hand, roentgen report may indicate frontal sinusiti

Fig. 1.—Roentgenogram taken in a case of advanced osteomyelitis of the frontal bone. The m tling indicates the decalcification that involves the ma part of both frontal bones. Note the large sequestr high up in the center of the mottling.

the unaffected side and normal appearance the affected side. This has happened twice this series. Operation confirmed the clini diagnosis. The cause of the miscalculation the roentgenologic evidence was a diffuse dec cification of both anterior and posterior bo plates of the affected sinus to such an extent t by comparison with the normally calcified bo of the unaffected sinus the latter looked dense.

When the "white line" disappears, beginni decalcification of the frontal bone outside region of the frontal sinus will be noted. longer can ineffective medical treatment be co tinued, and the occasion for surgical interventi is at hand.

BACTERIOLOGY

The staphylococcus has been the organis found in all cases in which a culture was ma

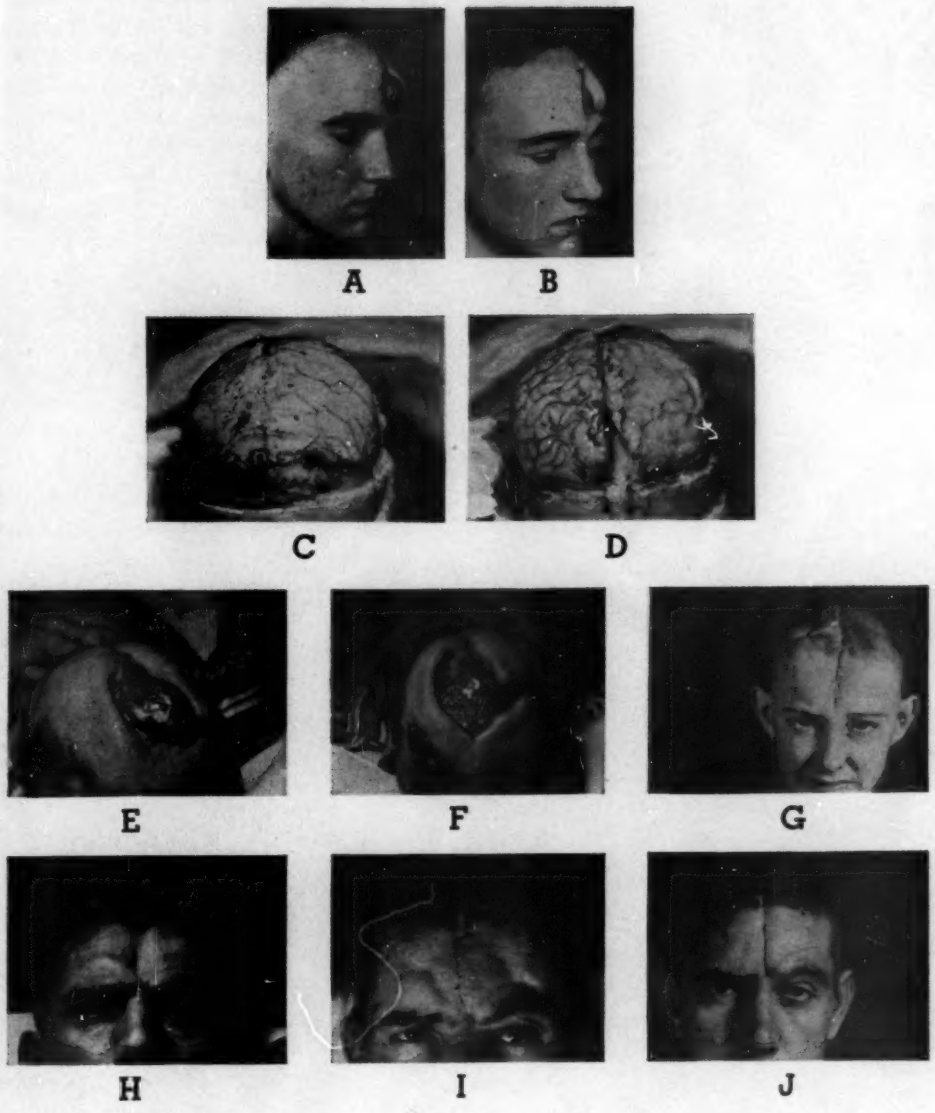

Fig. 2.—*A,* kodachrome showing an abscess of the left frontal lobe. The abscess has entirely everted, so that the mass seen projecting through the operative field is actually the posterior wall of the abscess capsule. *B,* kodachrome showing the same subject as in *A,* five weeks later, when the herniation of the brain has receded. *C,* kodachrome showing postmortem examination in case 1. The calvarium has been removed. The subject is viewed from the front. Note the white, bloodless appearance of the dura over the left hemisphere of the cerebrum. This bloodless appearance is due partly to the subdural pus and partly to the subdural pressure. *D,* kodachrome showing the same subject described in *C.* The dura has been removed to show the massive subdural abscess, and some idea is given of the large amount of pus that can form in these abscesses. *E,* kodachrome showing the "balls" of granulation that form over the edge of the bone where the edge is infected. The large swelling in the center is a subsiding herniation of the brain which followed incision of the dura to allow migration of an abscess of the brain to the surface. The patient is viewed from the rear and from above. *F,* kodachrome showing a later stage of the condition described in figure *E.* The infected bone has been removed, and the granulation grows evenly along the edge of the bone. The herniation of the brain has mostly receded. The edges of the flaps of skin have turned under. Epithelium may be seen growing out on the granulation which covers the dura from the anterior part of the operative field. *G,* kodachrome showing the same subject shown in *E* and *F.* The first stage of repair, in which the flaps are sutured together, has been done. In this case the transverse incisions were made along the line of the coronal suture, since the greatest width of infected bone was in this area. *H,* kodachrome showing a deep defect following operation for osteomyelitis of the frontal bone, an indication for an implant of fat before insertion of a vitallium skull plate. *I,* kodachrome showing the same subject as in *H.* Autogenous fat has been implanted. *J,* kodachrome showing the same subject as in *H* and *I,* three weeks after the vitallium plate has been inserted.

ith 1 exception. This exception occurred when patient with a violent infection was operated clinically earlier than any other patient in e series, and the pus from the field of operation elded streptococci. It seems possible that the aphylococcus could be a secondary infecting rganism, since most of the patients were seen d operated on somewhat late in the course the disease.

COMPLICATIONS

These in the order of frequency as they curred in this series were as follows: epidural scess, abscess of the brain, meningitis, subral abscess and subperiosteal abscess.

The following points were outstanding in rerd to the complications as they occurred in is series:

1. With epidural abscess there are no charteristic signs. The abscess is found when the steotomy is done, and the operation is not perrmed for removal of the abscess. The treatment removal of the dead bone encapsulating the scess. If there is no further complication at e time of the operation, the prognosis is good.

2. The patients with abscess of the brain had oked disks, and, conversely, the patients with oked disks had abscess of the brain. Treatent for this complication is begun at a second eration, not at the time of the osteotomy. hen the abscess is located by an exploratory edle, a 1½ inch (3.8 cm.) crossed incision is ade in the dura, the place of entrance of the edle being used as the point of crossing. The edle is removed. The abscess is allowed to igrate to the surface with or without aspiraon of the overlying brain tissue, according to the se. Migration may take many days. The scess is then widely incised, drained and ghtly packed, in an attempt to cause it to evert g. 2 *A*). After the acute inflammatory process e brain recedes to its normal confines (fig. 2 *B*).

3. Meningitis played a middle role, being both e third easiest and the third most difficult mplication to treat. Operation for complete moval of the infected bone, plus administraon of sulfonamide compounds by mouth and cal application of them to the operative field, gether with general supportive measures, sufced. Spinal puncture was done occasionally, t frequently.

4. Subdural abscess occurred twice, with 100 r cent mortality. Because the 2 fatal cases ere so strikingly similar except for the sex of e patients and because they have not cast y light on a favorable treatment for this conition, the histories will be briefly summarized ere.

CASE 1.—A white girl aged 16 was admitted to the hospital on the evening of April 5, 1939 and was seen by the resident physician for examination. Her chief complaint was severe frontal and occipital headache and profuse postnasal discharge. She gave a history of having contracted a bad cold, or influenza, two weeks before admission, which was followed in two days with swelling of the left side of the forehead. Examination revealed a rational 16 year old girl with an oral temperature of 102 F., a pulse rate of 86 per minute and a respiratory rate of 18 per minute. The eyegrounds did not show choking. There was a fluctuant swelling of the left side of the forehead, which extended down to the bridge of the nose and involved the upper part of the left eyelid. A large amount of purulent postnasal discharge was to be seen on the posterior wall of the pharynx. The resident physician aspirated the swelling of the forehead and obtained thick yellow pus. Although she was obviously ill, the patient's condition did not seem sufficiently serious for the attending physician to be called until the next morning. The patient was restless most of the night, and about 5 o'clock of the next morning, April 6, she told the nurse that she could not move the right side of her body. It was noted at that time that the right arm and the right leg were strikingly weaker than the left arm and the left leg, a condition not observed a few hours before on her admission to the hospital. Three hours later she had breakfast, consisting of liquids, and one hour after breakfast she suddenly became comatose, dying in forty-five minutes. despite the usual emergency measures. Postmortem examination revealed that the patient had osteomyelitis of the left frontal bone with perforation through the inner and outer tables. Further, there was a massive subdural abscess of the entire left cerebral hemisphere (fig. 2 *C*). When the dura over this was incised, the pus actually ran down on the autopsy table (fig. 2 *D*). She died apparently from compression of the medullary centers due to the cerebral edema which followed the encephalitis caused by the subdural abscess.

CASE 2.—The other patient, a white youth aged 18, was admitted to the hospital in coma at noon, April 10, 1939, four days after the death of the patient in the first case described. The history, given by the patient's mother, described the boy's' health as normal and excellent until three weeks before admission, at which time a severe cold developed. He continued going to school until ten days before admission, when he complained of severe headache and voluntarily went to bed. The next day, nine days before admission, the mother noticed swelling of the central region of the forehead and swelling of the upper part of the left eyelid toward the inner canthus. During the nine days prior to admission, the boy was rational and got out of bed occasionally as he desired. At 8:30 a. m. on the day of admission to the hospital, the patient's father helped him to the bathroom and then back to bed. Suddenly after this, the patient became rigid, remained so ten minutes and then relaxed, and he neither spoke nor moved thereafter.

Physical examination disclosed a well developed and nourished 18 year old white youth, cyanotic and completely comatose. White froth exuded from his mouth. No reflexes could be elicited, not even the corneal reflexes. The rectal temperature was 104.4 F., the pulse rate 140 per minute and the respiratory rate 30 per minute. The pupils were widely dilated. There was a fluctuant subperiosteal swelling of the middle of the forehead, measuring about 1½ by 2 inches (3.8 by 5 cm.), horizontally and vertically. The

swelling extended to the root of the nose. The upper side of the left eyelid was blue and edematous. At the left inner canthus was a fluctuant swelling about one-third the size of the swelling of the forehead. As the resident physician was proceeding with his examination, the patient suddenly ceased to breathe; however, action of the heart remained good. Artificial respiration was administered until an "iron lung" could be brought to the room and the patient placed in it.

With a diagnosis of osteomyelitis of the frontal bone originating from the left frontal sinus and complicated by a subdural abscess on the left side, the patient was operated on while residing in the "iron lung," totally unconscious. A 1 per cent solution of procaine hydrochloride was injected along the course of the incision to prevent any added shock to the patient, should such be possible. Most of the left frontal bone was removed, beneath which there appeared the white bloodless dura surmounting the subdural abscess. An incision 2½ inches (6.5 cm.) in length was made through the dura over the left frontal lobe parallel to and 1 inch (2.5 cm.) to the side of the superior sagittal sinus. Following this operation there was an initial escape of pus, but the inflamed brain tissue, under much increased pressure, wedged itself into the dural incision, obstructing further escape of the pus. Rubber tissue drains were placed beneath the dura. The patient lived in the "iron lung" without voluntary respiration for fifteen hours before action of the heart ceased. Postmortem examination disclosed findings similar to those described in the report of the first case, and, in addition, there was considerable herniation of brain tissue through the dural incision which was made at operation. Death in this case was thought to have come from the same causes as those described in the first case reported.

My conclusions from a study of these 2 cases of massive subdural abscess led me to believe that the only effective treatment for this complication is that used before this complication occurs.

5. Subperiosteal abscess by itself obviously would be the least dangerous complication and the easiest to treat, but it occurred infrequently alone. When it did occur alone, the operation for osteotomy obviated the complication.

TREATMENT

One of the most difficult aspects of the treatment is to bring oneself to carry it out. A surgeon with the responsibility of one of these patients first has to decide whether the patient really has osteomyelitis or whether he has some preosteomyelitic condition which may be treated without this radical operative procedure. If all patients with osteomyelitis were obviously mortally ill, decision would be less difficult, for both family and physician would agree that there was no alternative to operation, whereas in the earlier stages of the disease it might seem more unreasonable to the patient and the relatives to advise such a deforming operation on the strength of "what can and may happen." But with the assumption that the diagnosis of osteomyelitis has been made, treatment resolves itself into (1) the attempt to remove the area
infected bone with an area of good bone arou
it, (2) the attempt to prevent the spread of t
osteomyelitis to the supposedly uninfected bo
and (3) the treatment of complications.

Prior to operation the roentgenograms a
studied so that the amount of bone involv
may be decided. Measurements are taken fr
the roentgen film, and at the operation th
measurements are followed in the operative fi
by use of a metal ruler which is included in t
equipment of the operating room. The supra
bital incision, made just superior to the eyebr
and parallel to it, but never in it, and a midli
vertical incision extending from the glabella
the distal limit of the predetermined area
infection are used. Incisions are not made o
both eyebrows, laying bare the entire fron
bone, unless the infection involves both fron
sinuses, and it usually does not. By inspecti
and measurements the location and the size
the section of bone to be removed are determin
With an electric drill the surgeon makes bu
holes in the bone, circumventing the area
infection. The burr holes which are close
or which involve the frontal sinus are made la
This is done, of course, to aid in preventi
the spread of the disease. The burr holes a
connected by bone-biting rongeurs or the Gi
saw, and the diseased section of bone, with
surrounding healthy bone, is removed in o
piece. The edges of the remaining bone a
inspected for infected areas, as are the edges
the section of bone removed. If obviously i
fected bone remains at some point, this is r
moved with bone-biting rongeurs. The secti
of bone removed is immediately sent to t
x-ray room for a roentgenogram, which may a
in determining whether the infection is all i
cluded in the specimen (fig. 3*A*). Afterwa
the section of bone is sent to the laboratory f
microscopic analysis. When it is thought th
all diseased bone has been removed, the surge
covers the operative field lightly with a powder
sulfonamide compound, making sure that t
remaining edges of bone are especially w
treated. Whether the powder used is sulfath
zole or sulfanilamide does not seem to ma
much difference in the end result. Sulfanilami
powder will cause a large amount of serosa
guineous discharge, necessitating frequent dres
ings, sometimes as early as the first postoperati
night, a procedure which generally is not nece
sary with the use of sulfathiazole powder. T
fact that sulfathiazole powder is insoluble a
may become a foreign body is not a matt
for controversy here, as the incisions are l
open. Since sulfathiazole causes less postoper
tive drainage, its use has been preferred

e time of operation, but the sulfanilamide wder may be used at subsequent dressings. fter application of the sulfonamide compound wder, a narrow strip of gauze is inserted tween the remaining edges of the bone and e periosteum, and the exposed dura is covered ith rubber tissue, on which is placed plain uze. By the time the operation is concluded, e patient usually has received a transfusion of trated whole blood. Other such transfusions ay be necessary in the next forty-eight hours, cording to the condition of the patient.

needle being used in the method described unless there is gross infection over the dura, such as an epidural abscess. A powdered sulfonamide compound is again applied to the operative field and to the edge of the bone; plain gauze packing is again inserted between the edge of the bone and the periosteum, and plain gauze may now cover the dura without the rubber tissue. Subsequent dressings are done at intervals of three to seven days without anesthesia.

It becomes increasingly difficult to keep the incisions wide open, as is necessary for careful

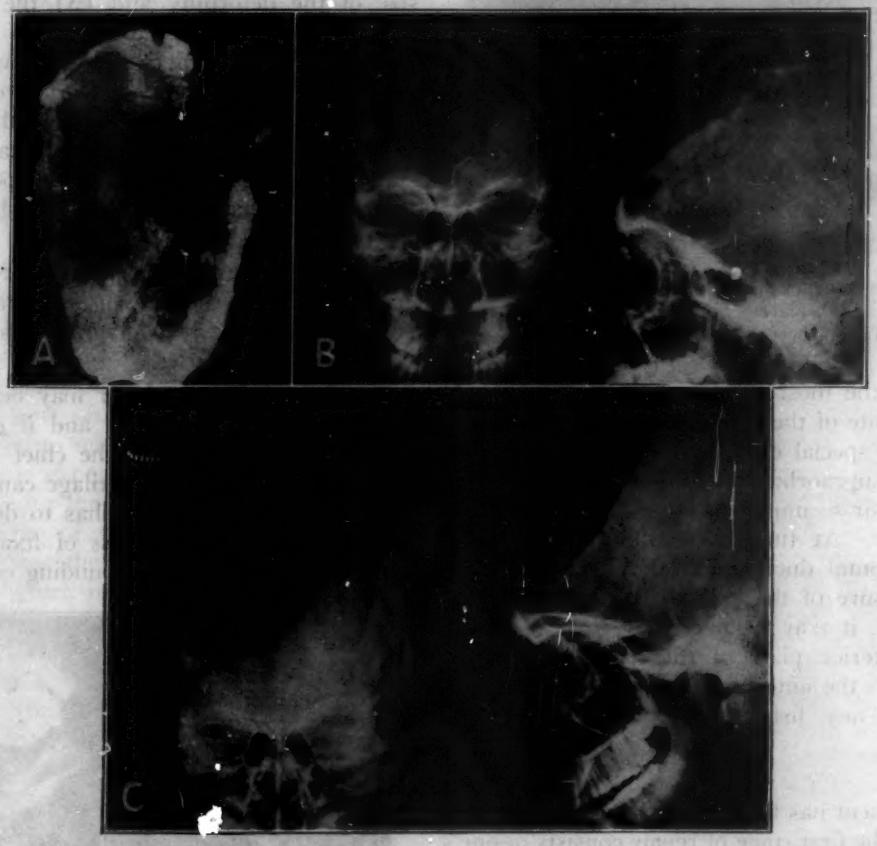

Fig. 3.—*A*, roentgenogram showing a large section of a right frontal bone immediately after osteotomy; parently there is healthy bone all around the infection except at the medial aspect of the top; *B*, roentgenram showing spread of the infection into the surrounding bone, as demonstrated by the ragged, moth-eaten pearance of the edges of the bone; *C*, roentgenogram showing a smooth edge of clean, healthy bone after the fected edges of the bone seen in figure 3 *B* have been removed.

The anesthetic of choice is pentothal sodium. t is administered entirely apart from the field f operation; it receives universal acclaim from e patients; apparently it can be used repeatedly ithout permanent ill effect.

The first postoperative dressing is done on the fth day, with the patient under pentothal sodium nesthesia. All dressing, including the packing, is emoved. The sulfonamide compound is comletely washed out. If there exists such comlication as abscess of the brain, it may be earched for at this time, a brain-exploratory

inspection of the edge of the bone. This is important. One can tell almost with certainty the condition of the edge of the bone, whether healthy or infected, by the appearance of the granulation growing over it. When the granulation mounds into "balls" at various places along the edge of the bone (fig. 2 *E*), there is in each "ball" a sequestrum which has to be removed before healing can occur. Penetration of the "balls" with a blunt instrument will reveal pus. If a roentgen film of the skull is made at this time, it will show the moth-eaten, ragged edges

of bone characteristic of a spreading of the infection in the bone (fig. 3 *B*). When this infected bone has been removed and the new edge of bone is healthy, granulations will grow smooth and will not be proliferative (fig. 2 *F*). A roentgenogram of the skull will then show an edge of clean bone (fig. 3 *C*), and as far as the osteomyelitis is concerned the incisions are ready for closure.

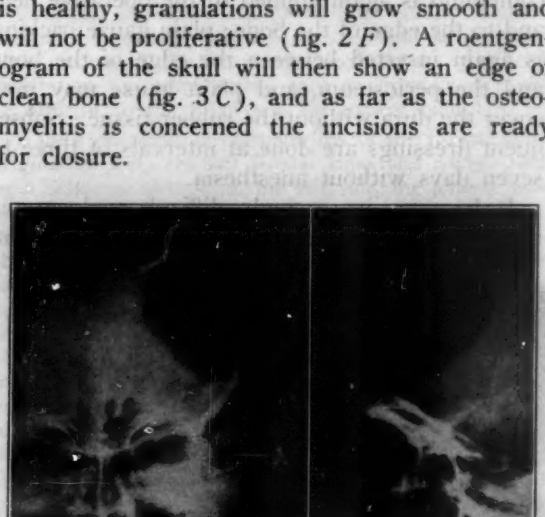

Fig. 4.—Roentgenogram taken just prior to insertion of a vitallium skull plate. The edges of the bone appear free of infection, a prerequisite to any plastic work.

One of the most troublesome points of healing is the site of the frontal sinus. In this group of cases, a special effort has been made to preserve the supraorbital ridges and thus to make plastic repair so much easier and definitely more satisfactory. At times a draining fistula from the nasofrontal duct will continue to prevent a plastic closure of the skin. In order to correct this fistula, it may be necessary to remove the entire posterior plate of the frontal sinus, together with the anterior ethmoid cells, for there cannot be any fistula when closure is to be attempted.

REPAIR

If treatment has been carried out by the "open method," the first stage of repair consists of one's bringing together the flaps of skin. No repair can be attempted until all infection and any complication have been controlled. By that time the flaps of skin have usually turned under at their edges, and epithelium may have grown on the granulation which covers the dura (fig. 2 *F*). The flaps of skin are then dissected up from the dura and the edges of bone, and the scar tissue on the deep surface of the flaps is loosened so that the flaps can lie perfectly flat. Any epithelium which has grown out on the granulation covering the dura must be dissected free and discarded. The flaps of skin are then approximated (fig. 2 *G*). A sulfonamide compound is not placed under the flaps or in the incision.

The second stage of repair, correction of the deformity of contour, can be carried out only when the flaps of skin have completely heal It is well to wait three to six months after t first stage to give them sufficient time to beco firmly attached to the underlying tissue and secure strong closure of any possible fistu such as the remains of the nasofrontal duct.

It is not absolutely necessary to accompli the second stage of repair. Whether or not t is done may be decided by the surgeon's adv and by the patient's choice. Three factors en into the patient's decision: (1) his conce about having a "soft spot" in his head, (2) t size of the deformity and (3) the location the deformity. Most patients wish to have t plastic correction carried out; however, so patients with the largest defects have been sat fied with the closure of skin, and they feel th they have had quite enough surgical treatme As a rule, their progress from this point is mu the same as that of the patients who have h the plastic work.

For the correction of the deformity (cartilage from a cadaver,[2] (2) a graft of auto enous bone and (3) a plate of vitallium[3] ha been used in this series.

Cartilage from a cadaver may be used if t deformity is not too large and if one piece cartilage can suffice, but the chief objection this method is that the cartilage cannot grow the surrounding bone and has to depend on i fibrous bed for its firmness of fixation. If t cartilage overlaps the surrounding edges of bo

Fig. 5.—Roentgenogram showing the vitallium pla in place. Note the projecting feet of the plate. In t feet are the screw holes through which the plate screwed to the skull.

and this gives it greater strength for support, may show through the skin as an elevation. it is fitted into the deformity, it will not affo

2. O'Connor, J. B., and Pierce, G. W.: Refrige ated Cartilage Isografts, Surg., Gynec. & Obst. **67**:79 798 (Dec.) 1938.

3. Geib, F. W.: Vitallium Skull Plates, J. A. M A. **117**:8-12 (July) 1941.

appreciable amount of support and since it ll rest against the dura visible pulsation usually urs. Cartilage of a cadaver does not seem to be answer to correction of these deformities.

The graft of autogenous bone is popular. rgeons have used various methods of obtaining d implanting the bone, which vary from grafts nsisting of strips of tibia or pelvis to accurately asured split sections of the skull. The latter thod probably gives a smoother result, but it a difficult operation. The strips of tibia are ier to obtain and to insert, but the result is t so smooth. In either event, infection may ur under the strictest aseptic precautions. times even when no infection has been parent there will be some absorption, and any sorption of the graft detracts from the cosmetic ult. If infection does occur the graft must removed, for if left in place it will absorb, ich can mean only a long period of a foul, scharging fistula in the forehead.

No doubt, the repair of a cranial defect with a tallium plate has not had sufficient trial to rrant a final decision. Possibly, correction injuries caused by the present war may cast ore information on the subject, but, even so, is method now promises to be that of choice. is necessary to make a mold of the deformity d to include enough of the head adjacent to e deformity for the laboratories to estimate the rrect contour of the skull plate. The plate ightly overlaps the edge of the bone and has all "feet" which include screw holes, through ich the vitallium screws are inserted. The rew holes in the skull are made with a dental ill carrying a burr of the proper size. The ate is so thin that when the skin and the eriosteum are pulled over it, the edges of e plate do not show through the skin. When vitallium plate has been inserted and screwed wn, the patient has assurance of unusual pport over the bony defect, and injury to e intracranial contents is probably less likely re than anywhere else in the skull (figs. 4 and . Where the deformity is deep (fig. 2 H), a graft of fat to elevate the depression (fig. 2 *I*) and cause less or no dead space under the plate, is a definite advantage; for at times, when there is a sizable area of dead space under the plate, the flaps of skin over the plate will not completely heal, and yet there does not seem to be an infection. If the plate is then removed and a graft of fat inserted and allowed time to "take," the plate may be reinserted, and the flaps will heal by first intention (fig. 2 *J*).

MORTALITY

There were two deaths in this series; both were in cases in which the condition was complicated by massive subdural abscess, and both these cases have been described.

SUMMARY

In this series of 10 cases of osteomyelitis of the frontal bone, complications were present as follows: epidural abscess and abscess of the brain in 4 cases; epidural abscess (alone) in 3; subdural abscess in 2; subperiosteal abscess in 1.

It seems remarkable that in these 10 cases, all involving complications, meningitis was a prominent factor only three times.

CONCLUSIONS

1. Fully developed osteomyelitis of the frontal bone is a problem for surgical, not for medical, treatment.

2. Complications occur frequently before osteotomy, but after the operation the chief offender is spread of the infection in the surrounding bone.

3. Although roentgen evidence of osteomyelitis is manifested only after the infection has been in the bone several days, roentgen examination is nevertheless a worth while and at times a deciding factor.

4. Use of vitallium skull plate promises to be the method of choice for the repair of the deformity caused by the osteotomy.

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RECENT PROGRESS IN MANAGEMENT OF ACUTE SUPPURATION OF THE MIDDLE EAR

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The management of acute suppurative disease of the middle ear has made great advances over a period of ten to fifteen years. As a result the disease has lost many of its dreaded aspects. The frequency with which surgical intervention is necessary for acute suppuration has materially decreased, and even those complications which in former years were accompanied by an extremely high mortality now assume a much less hopeless outlook.

This improvement has been brought about along two distinct lines, the development of methods for diagnosis and treatment of suppuration in the petrous pyramid and the application of therapy with sulfonamide compounds in this field. Both of these advances have been the outgrowth of many years of investigation.

The development in surgical management preceded the advent of therapy with sulfonamide compounds. Progress had reached the point where suppurative disease in the pyramid could be diagnosed and located and a suitable surgical approach selected when surgical treatment was indicated. The prevention of serious complications from undrained foci in the pyramid became possible, whereas in former years it had not been uncommon to witness the steady development of meningitis or other complications despite thorough exenteration of the mastoid.

The history of the advance in surgical management contains many brief reports published in the years previous to 1930. The systematic studies of Eagleton [1] about that time marked the beginning of a series of pathologic, anatomic and roentgenologic studies [2] from which there gradually evolved a more widespread understanding of the problem. A variety of surgical approaches were proposed,[3] all of which had proved successful in certain types of cases. Complete correlation of pathologic, anatomic and roentgenologic studies has demonstrated the particular merits of each of these surgical approaches and has made possible an orderly sequence of surgical steps which combine adequate management of all types of conditions with the greatest degree of conservatism.

This advance in the surgical management of acute suppuration of the middle ear applies only to those patients in whom the petrous pyramid was pneumatized. While these include approximately one third of all the patients over the age of 3 years, only a limited number of these persons failed to have adequate drainage through the middle ear or as a result of mastoidectomy. The total percentage of patients affected, therefore, was not large, but it included most of those in whom serious or fatal complications developed despite all that could then be done to prevent them.

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2. (*a*) Eagleton, W. P.: Unlocking of the Petrous Pyramid for Localized Bulbar (Pontile) Meningitis Secondary to Suppuration of the Petrous Apex, Arch. Otolaryng. **13**:386-422 (March) 1931. (*b*) Taylor, H. K.: The Roentgen Findings in Suppuration of the Petrous Apex, Ann. Otol., Rhin. & Laryng. **40**:367-3 (June) 1931. (*c*) Kopetzky, S. J.: The Symptomatol and Diagnosis of Suppurations of the Petrous Pyram Laryngoscope **41**:398-404 (June) 1931. (*d*) Fowler, P., Jr.: Suppurations of the Petrous Tip, J. A. M. **102**:1651 (May 19) 1934. (*e*) Nager, F. R.: Sign cance of Roentgen Examination in Suppuration of Apex of the Pyramid, Acta radiol. **15**:475 (July) 19 (*f*) Mayer, O.: Die Pyramidenzelleneiterungen, Zts f. Hals-, Nasen- u. Ohrenh. **42**:87-93, 1937. (*g*) Li say, J. R.: (1) Suppuration in the Petrous Pyram Ann. Otol., Rhin. & Laryng. **47**:3-36 (March) 19 (2) Petrous Pyramid of Temporal Bone, Arch. O laryng. **31**:231-255 (Feb.) 1940; (3) Pneumatization the Petrous Pyramid, Ann. Otol., Rhin. & Laryng. 1109-1113 (Dec.) 1941.

3. (*a*) Eagleton.[2a] (*b*) Almour, R.: Surgical Th apy for the Relief of Suppurations of the Petr Pyramid, Laryngoscope **41**:405-406 (June) 1931. Frenckner, P.: New Observations in Treatment Apicitis, Acta oto-laryng. **28**:1-54 (Jan.-Feb.) 19 (*d*) Ramadier, J.: Exploration de la pointe due roc par la voie du canal carotiden, Ann. d'oto-laryng., A 1933, pp. 422-444. (*e*) Myerson, M. C.; Blumberg, and Rubin, H. W.: Proposed Operation for Osteom litis of Inferior Aspect of the Petrous Pyramid, Ar Otolaryng. **25**:373-381 (April) 1937.

By comparison with surgical intervention, the vent of therapy with sulfonamide compounds s constituted a much greater advance in treatnt of this disease.

DICATIONS FOR TREATMENT OF OTITIC SUPPURATION WITH SULFONAMIDE COMPOUNDS

The property of sulfonamide compounds to inbit bacterial growth with comparative safety m toxicity to the host has provided an inluable means of inhibiting the spread of those fections producing acute suppuration of the ddle ear.

The control of infection in this location prents a special type of problem comparable somehat to that of infection in the paranasal nuses in that the system of air spaces provides r an accumulation of purulent discharge. It is own that any abscess or accumulation of neotic material, particularly within bony walls, is sistant to the action of sulfonamide compounds. herefore suppuration in large cell systems will influenced less by chemotherapy, and any alady existing areas of necrosis are likely to perst.

The most effective time for chemotherapy of ppuration of the middle ear should be in the vasive stage. In the presence of a severe fection of the upper respiratory tract the first gns of invasion of the middle ear should be e indication for considering such therapy. lfonamide compounds have a definite incidence toxicity, however, and their use in effective ncentrations cannot be carried out in safety cept under definite precautions and is therere not indicated in every case of inflamed ear rum. The experienced otologist can usually lect those cases in which there is likely to be ogress to active suppuration on the basis of e type and the severity of the infection in the per respiratory tract. In these selected cases ere should be chemotherapy as early as possible. he drug usually preferred at the present time is lfadiazine, and the blood concentration to be fective at this early stage should be from 6 to mg. per hundred cubic centimeters. Initial ses should be gaged to attain this concentration ickly. Maintenance of medication for two to ree days may be sufficient.

When suppuration is already present therapy ith a sulfonamide compound is indicated for all cept mild or subsiding infections. The conntration should be higher, from 8 to 15 mg. r hundred cubic centimeters. It may be necesry to continue at this level for several days. xperience shows that signs of toxicity are more equent as the therapy is prolonged. It is advisable, therefore, to attain a high concentration for three to five days and then to decrease it.

If definite surgical indications are present before chemotherapy, the best interest of the patient demands that surgical intervention be carried out. In the presence of a severe systemic reaction or of signs of impending complication an effective concentration of the drug in the blood should be attained before surgical intervention is attempted. This usually requires intravenous administration of 5 Gm. of sodium sulfadiazine in 1,000 to 1,500 cc. of fluid for the average adult before the operation, followed by a similar amount within the first eight or ten hours. In the case of sulfadiazine intravenous medication is usually necessary to produce a high concentration quickly, but after the first twenty-four to forty-eight hours the level may be kept up with a considerably smaller dose by mouth. In the presence of a complication, such as thrombosis of a venous sinus or meningitis, a blood concentration of 15 mg. per hundred cubic centimeters or over should be attained as early as possible.

Time appears to be an important factor, particularly with pneumococcic meningitis. Intravenous administration is therefore essential at the onset and may have to be continued because of vomiting. The latter may occur as an effect of the intracranial condition or may be produced by the drug when used at such concentration. The duration of therapy depends on the condition being treated. The principle of giving maximum dosage at the beginning is important, while the time to lower the concentration will be determined by the clinical condition. Treatment of otogenous meningitis and of invasion of the blood stream has been sometimes successful without operation on the mastoid. Sufficient experience has been obtained, however, to demonstrate that surgical exenteration or drainage of the suppurating focus in the bone should always be done. To exclude the presence of such a focus either in the bone or between it and the dura requires surgical treatment. The surgical principles already established before the use of sulfonamide compounds have not been altered.

Sulfadiazine has met with greater favor for the treatment of meningitis because higher concentrations of the drug in the cerebrospinal fluid are obtained with its use than with that of sulfathiazole. In many cases meningitis has been cured with sulfathiazole, however, although the level in the cerebrospinal fluid rarely reached 3 mg. per hundred cubic centimeters. The dosage necessary to maintain a desired concentration of sulfadiazine in the blood varies widely. When

high concentrations are being used it is preferable to determine the level daily and to regulate the dosage thereby. The total concentration is usually only slightly higher than the free, but the acetylated portion has been observed to increase greatly after several days of high concentration, probably increasing the load on the kidneys.

TOXICITY

All of the sulfonamide compounds in common use have caused serious toxic effects. Many isolated cases of toxicity have been reported. The recent report by Sutliff and his group [4] provides valuable information on the incidence of fatal toxicity resulting from the use of sulfonamide compounds.

Sulfadiazine usually produces the least amount of subjective discomfort but requires as close supervision as the other sulfonamide compounds. Complications involving the kidney are most frequent and require certain precautions. Previous damage to the kidney is an indication for extreme care in administration of the drug.

In all cases a high intake of fluid distributed through the day and the night must be assured. A minimum of 3,000 cc. of fluid daily for the average adult appears to be essential for safety. Dehydration before one starts therapy must be taken into consideration. If the urinary output is checked and the urine examined daily, any signs of renal damage will usually be detected early. In the absence of previous renal disease an adequate intake and output of fluid are usually sufficient protection.

Agranulocytosis and anemia occur sufficiently often to require frequent examination of the blood while high concentrations are in use. This examination should be made at first every day, and then at least every second day until the drug has been excreted. The appearance of a dermatitis is a danger signal and an indication for immediate cessation of the use of the drug. In the occasional case the dermatitis may appear shortly after the beginning of therapy. It is likely to appear after a prolonged period of treatment with a high concentration. Substitution of another sulfonamide compound may be possible without unfavorable reaction.

The use of sulfonamide compounds for persons who have had a previous course of treatment should be carried out with caution, since a sensitivity may exist and fever or a cutaneous reaction appear within a few hours.

4. Sutliff, M. D.; Helpern, M.; Griffin, G., and Brown, H.: Sulfonamide Toxicity as a Cause of Death in New York City in 1941, J. A. M. A. **121**:307-312 (Jan. 30) 1943.

MASKING

The tendency for therapy with a sulfonamide compound to depress and obscure the well recognized symptoms and signs of danger has been frequently considered a contraindication to its use. This masking effect is, however, merely an indication of the efficacy of the therapy in inhibiting the extension of the infection. The patient should not be denied this protection. The indications for surgical intervention have been considerably modified, however, and more careful observation is necessary. The presence of definite indications for surgical treatment before chemotherapy is started means that operation is still essential for greatest safety, although the symptoms and signs may be depressed temporarily or even disappear. The development of danger signs during chemotherapy must be evaluated in the light of the concentration of the drug in the blood stream. Progress and spread of the infection in the presence of reasonably high blood levels usually indicate the necessity for surgical treatment. The period when the dose of the drug is being decreased requires most careful observation. The appearance of signs of reactivation or spread may demand resumption of the drug therapy and surgical treatment.

In all cases of severe infection of this type whether surgical intervention becomes necessary or not, the drug provides invaluable protection to the patient and additional security to the surgeon.

LOCAL THERAPY

The opportunity for local application of sulfonamide compounds in the treatment of acute suppuration is limited to postoperative use in mastoidectomy cavities. It has been demonstrated that the wound may be closed and healing occur by first intention in at least a high percentage of cases by the enclosure of sulfathiazole powder. In considering the advisability of such a method two questions arise, the possibility of an irritative reaction in the middle ear with some resulting impairment of the sound-conducting mechanism and the possible inhibition of drainage from a deeper focus around the labyrinth.

The local use of a sulfonamide compound after operation must not be considered as a substitute for thoroughness in operative technic. The method of dusting a small amount of sulfanilamide powder into the wound, suturing all except the lower end and leaving a soft rubber drain from the region of the antrum has given satisfactory results.

EFFECT ON PREVENTION OF DEAFNESS

It seems reasonable to expect that with improvement in general medical care the necessity for surgical intervention in treatment of acute suppuration of the middle ear may decrease further. There is reason to question, however, whether the effect of such improved medical care on the development of deafness will be as favorable.

The occurrence of disease of the middle ear is usually associated with improper functioning of the eustachian tube. The ultimate efficiency of the tube and the conducting mechanism of the middle ear is usually decided in childhood. The detection and proper treatment of tubal dysfunction in these years become a matter of primary importance and require special training and skill.

It should be realized that, although therapy with a sulfonamide compound may stop the infection, the ear may be left with an impairment of function. The responsibility of the physician does not cease until function has been restored and includes the evaluation and the correction of any predisposing factors. Unilateral impairment of hearing in a young child may exist for years before detection unless the other ear also becomes involved. To the untrained eye a tympanic membrane may appear relatively normal, yet the spaces of the middle ear may be filled with fluid and hearing be seriously impaired.

The greatest prospect for improvement in the prevention of deafness lies in closer attention to the recognition and treatment of dysfunction of the eustachian tube in early years.

COMMENT

Although chemotherapy has been in use for only a few years, its effect in such fields of application as acute suppuration of the middle ear has been spectacular. The present day methods are also likely to be succeeded by new improvements as investigation of new drugs proceeds.

The effects have been most evident in the section of the population receiving the best medical care, and for this group the number of operations has been greatly decreased. Large sections of the population do not receive such prompt and adequate care, however, and the toxic effects of sulfonamide compounds are too great to permit their safe use without medical supervision. Although operations on the mastoid have decreased in frequency, there is little indication that they may become obsolete. The competent otologist must be familiar with the anatomic and pathologic basis of intelligent management, and he must be trained in diagnostic methods.

Experience has shown that many fatalities from intracranial suppurative disease [2g] originated from an unrecognized focus in the ear. The incidence of complications has decreased, but the necessity for basic training in diagnosis and surgical methods still exists.

ANATOMY AND ROENTGENOLOGY OF THE PETROUS PYRAMID

By means of pathologic studies of temporal bones which had been serially sectioned the basic fact became clear that suppuration of the petrous part of the bone depends on the presence of pneumatization. Infection enters by pneumatized tracts. These tracts follow definite patterns. Suppuration develops as it does in the mastoid, but because the apical part always contains bone marrow the focus of suppuration includes the marrow. Varying degrees of osteomyelitis are therefore a constant finding. This condition tends to remain localized and heals rapidly after drainage, but may invade the base of the sphenoid. If osteomyelitis is allowed to become chronic the prospect of a cure through surgical intervention is greatly decreased.

An acute fulminating type of osteomyelitis of the apex in infants has been reported,[5] but careful pathologic examination of the temporal bones by means of serial sectioning has demonstrated a striking absence of otogenic osteomyelitis of the pyramid without preexisting pneumatization of the area through which the infection entered. A knowledge of the anatomy of pneumatization provides the basis for interpretation of clinical symptoms and signs, of roentgenologic demonstration and of surgical approach. Routine serial sections of temporal bones [2g] closely correlated with roentgenologic and clinical studies form the basis for a simple classification on a practical basis. The petrous pyramid is pneumatized in the perilabyrinthine region in about 35 per cent and in the apex in about 20 per cent of the temporal bones studied.

The fact that there are two main sources of pneumatization, a posterior route and an anterior route, creates a possibility for two types of petrositis, a posterior and an anterior. The chief value of such a differentiation is a practical one. The posterior type may be approached and drained surgically without sacrificing the conducting apparatus of the middle ear. This type

5. Siebenmann, F.: Otogenic Osteomyelitis in Children, Cor.-Bl. f. schweiz. Aerzte 49:1737 (Nov. 6) 1919.

includes all perilabyrinthine cells and the extension of these cells into the apex, if present. The anterior type usually cannot be drained from the simple mastoid approach.

POSTERIOR GROUP OF CELLS

Perilabyrinthine cells vary greatly in distribution. The superior group (35 per cent) develops most often from the attic in front of the superior semicircular canal and is joined in about half the cases by a tract through the angle. The presence of this group is best demonstrated roentgenologically by the Stenver projection. The presence and size of the tract through the angle are indicated by the occipital or occiput-down view.

Certain bones (5 to 10 per cent) are so constructed as to have a tract of cells lying between the aquaeductus endolymphaticus and the posterior cranial fossa. This may not extend as high as the angle and therefore requires an occipital projection[6] for its demonstration by roentgen examination. Surgical approach may be made from the mastoid along the tract. Such a tract may not be visible grossly. Therefore roentgenologic evidence of its existence is essential before surgical intervention is undertaken.

The tract of cells which frequently lies beneath the labyrinth is not sufficiently well shown by roentgen examination for useful diagnosis but can usually be discovered and drained by careful search in the region of the retrofacial cells.

This infralabyrinthine group may reach only to the jugular bulb, but in a small number of the bones in which it exists, 5 per cent or less, there may be cells between the bulb and the labyrinth and also in the lower part of the apex. These usually develop from more than one point of origin but in disease form a possible surgical approach from the mastoid to the apex.

As the pneumatization becomes more extensive the tract in the angle is likely to extend over the internal meatus into the angle of the apex. Such an extension is clearly shown on the Stenver view, and the width of the tract at the bottleneck where it passes the superior canal is shown in the occipital view.

The transorbital views also will demonstate this type of pneumatization. Surgical approach may be either along the intrapetrosal route through the angle or along the extrapetrosal route through the middle fossa without radical mastoidectomy.

6. Hodges, P. C.: An Apparatus for Stereoscopic Roentgenography of the Skull, Am. J. Roentgenol. **42**: 921-929 (Dec.) 1939.

ANTERIOR GROUP OF CELLS

The apical portion of the bone may be pn matized to a varying extent from the ante part of the tympanum or the mouth of eustachian tube. This occurs in about 15 cent of the patients. The tract may ext through the triangle between the knee of the ternal carotid artery, the cochlea and the co of the middle fossa but in the great majorit persons it passes either behind or in front of ascending portion of the internal carotid art The pneumatized part of the apex is usually lower half. Consequently the Stenver vi which shows the angle, may fail to show region. A mentovertical or axial view is m useful to show the apical part of the bone.

Because the cell tract is usually located in lower half of the apex, the surgical approach way of the middle ear and the mouth of eustachian tube is most feasible. Entrance the apex meets with least resistance if the p of pneumatization is followed. Suppuration sometimes drained spontaneously through lower surface into the neck or the pharynx this type. Spontaneous cure has sometimes lowed drainage of the superficial abscess. Su cal approaches have been proposed through neck or the nasopharynx to the lower surface the pyramid but have not been proved to practical.

COMMENT

The same general principles which apply suppuration in the mastoid apply to suppurat in the pyramid. Only a minor proportion suppurations in this region ever require surg drainage, and many of these receive suffici outlet by means of a thorough mastoidecto The primary value of a roentgen examinatio to determine the extent of pneumatization. A interpretation as to the pathologic changes m be made with extreme care. Indications for s gical intervention are based on evaluation of clinical condition combined with roentgenolo information.

Observations during the past decade h shown that suppuration in the pyramid has b directly responsible for many of the unsatisf tory results after mastoidectomy. About 20 cent of the instances of sinus thrombosis in experience have resulted directly from ap suppuration. Sinus thrombosis occurring a mastoidectomy or appearing first in the jugu bulb or vein suggests an origin in the infer petrosal sinus from a focus in the apex.

The persistent mastoidectomy fistula is lik to have as its source a poorly drained focus the pyramid. Location and adequate drain

the focus contribute much to a successful secdary closure.

Invasion of the labyrinth is predisposed to by ensive pneumatization of the pyramid. Such arrangement has been shown to be a predising factor in some cases of sequestration the labyrinth.[7]

The explanation of many of these unfavorable sults following good surgical treatment of the mastoid has been made possible by systematic study and correlation of anatomic observations and roentgenologic visualization. Diagnostic training in the specialty should include this basic knowledge of the cell system of the middle ear. If the training in diagnosis includes these fundamentals the interpretation of the clinical picture is simplified. The special surgical approach which may be required in the occasional case becomes a lesser problem.

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7. Proctor, B.; Lindsay, J. R., and Gonne, W. S.: questration of the Osseous Labyrinth, Arch. Otoyng. 37:819-830 (June) 1943.

HEAD NOISES IN NORMAL AND IN DISORDERED EARS

SIGNIFICANCE, MEASUREMENT, DIFFERENTIATION AND TREATMENT

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Tinnitus should be considered not only as a symptom of aural disease but also as a symptom frequently accompanying disorders of other portions of the body. It may greatly affect the tolerance of other symptoms of disease. It should not be ignored. Tinnitus is always accompanied by deafness in the frequency band of the tinnitus and often also below and above the frequency band of the tinnitus, but aural disorders with or without deafness may not be accompanied by tinnitus. However, tinnitus is present in over 85 per cent of patients with aural disease. In 2,000 consecutive patients I found it present in 86 per cent. It may be, and often is, present in some form in persons who have no apparent aural or other disease. It may be absent though there are most severe and distressing disorders of the ear and of other body tissues.

The therapy of head noises has been unsatisfactory mainly because attention has been focused too much on the symptom and not enough on its cause and on its place of origin.

ETIOLOGY

All head noises are the result of stimulation of the sensory auditory neurons (whether locally or distally produced). They are basically of two kinds: (1) vibratory and (2) nonvibratory. (These may operate singly or in combination and may be transient, recurrent, intermittent or constant.)

Vibratory Head Noises.—Real sounds, mechanical in origin, arising within or brought to the ear through the various hard or soft, fluid or gaseous mediums of the body, are vibratory noises. They originate especially in muscle contractions and spasms and in movements or changes in the surface tension of mucus in the nasopharynx, the eustachian tube, the middle ear and contiguous spaces (air bubbles). They arise from the sounds coincident with deglutition, especially from the muscles attached to the eustachian tube, and in the middle ear; these often are rumbling in character as muscle sou have frequencies of near 18 per second; oft they are hemic murmurs, as in some of the a mias, or bruits from the venous or arterial ch nels, from aneurysms or irregularities in t vessels of the head, neck and chest, but seld from intracranial aneurysms. Vibratory tinni is one of the objective signs of such vascu disturbances. It is a real sound and is receiv by the ear as such. It is not in essence direc due to dysfunction of the auditory neural mec anism of hearing.

Autogenous vibratory head noises, which rea the ear mainly by tissue conduction, are oft difficult for people to locate as to their point origin. Like all sounds heard largely by bo conduction, they are usually heard louder the ear with obstructive deafness. Their lou ness is dependent on the amplitude with whi they reach the inner ear and on the degree a the type of deafness. These sensations, like tho caused by actual sounds, odors, lights, tastes a touch, are in most people not greatly exagge ated, because they are sensed like other soun and can therefore be quite readily rationaliz They are real sounds; they are not illusions sound. Except for some hemic murmurs th are usually constant in character but not intensity. Though present in both ears th are usually sensed only on the side on whi they are louder, being then masked out in t opposite ear. When tonal in character vibrato tinnitus is low in frequency.

Nonvibratory Head Noises.—Tinnitus of t nonvibratory type is caused by biochemical ir tations of the auditory neural mechanism. is an illusion of sound but not of irritation. is this category of tinnitus which I particular wish to discuss in this paper.

Tinnitus frequently occurs in organic disea of the brain and in some of the psychoses. is then an auditory hallucination, but may influenced by actual vibratory or nonvibrato tinnitus otherwise engendered. Hallucinato tinnitus belongs in the domain of the neurologi and will not be discussed herein. However, the is a large element of psychic reaction accompan

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g all tinnitus exaggerated out of proportion to s character and real loudness. One reason for exaggerated reaction in nonvibratory tinnitus that it requires an extremely small addition to e biochemical irritations to bring about a arked increase in the sensation. This, in my inion, is due in large part to the operation of e "recruitment phenomenon." This phenomon operates in all the nerves of sensation, but fifteen years after discovery, still generally nored as a factor in many otherwise unexplainle phenomena. I see no reason why it cannot sult from illusions of sensations (from nonbratory tinnitus, for example) as well as from nillusionary sensations (for example, real unds).

Tinnitus caused by irritation may be audible subaudible, depending on whether the irritaon is sufficient to bring the neural response ove the threshold of sensitivity. This threshold dependent not only on the severity of the irriion and the degree of nerve involvement, but the masking effect of environmental noise and erefore also on the degree of any accompanying structive deafness. Millions of people are subct to faint head noises to which they pay little tention because these noises faintly resemble ternal sounds, but once the noises are accenated without obvious cause they become disrbing. All that I have said seems quite obvious, t its implications are far reaching and not ually considered in detail.

DIFFERENTIATION OF NONVIBRATORY FROM VIBRATORY TINNITUS

The otologist can usually differentiate nonbratory from vibratory tinnitus very easily, beuse the latter being a real sound is usually dible not only to the patient but also to the aminer if a proper listening device is proded. The auscultation tube or a two way thoscope may suffice, but sometimes it is cessary to amplify the tinnitus to enable the aminer to hear it. Nonvibratory tinnitus is audible to the examiner because it does not ist as a real sound. Some day a way may be vised to pick it up as a nerve potential. This s not as yet been accomplished.

To determine the seat of origin of tinnitus e must keep in mind that irritation anywhere ong the auditory neural tracts, whether direct indirect through the autonomic nervous sysm, can cause tinnitus in the same way that ritation anywhere along the course of the ocular any other sensory nerve tract can cause a nsation. With sufficient irritation of the ocular nerves there are flashes of blinding light; with irritation of nerves of the ear there are salvos or rushes of deafening sound.

No tinnitus has been observed through animal experimentation (Drs. Lorente de Nó, Bray, Davis and Weaver tell me they have never observed tinnitus in their experiments on animals), and there are many reasons why this may be so, but I cannot take the space to go into them at this time. On the other hand, it is easy to bring about or change in some degree tinnitus in the human patient, in oneself. This must now be the main source of experimental information.

Familiar instances of experimental tinnitus follow: There are the acoustic shocks from continuous loud sounds, explosions or blows on the ear, and there are the irritations from poisons and drugs such as quinine, the sulfonamide compounds and the salicylates. Many of the sedatives and anesthetics may be used to accentuate or diminish tinnitus. Sudden changes in intralabyrinthine pressure, as those brought about by direct or indirect pressure on the stapes, straining at stool, interference with the cranial circulation as in the head down position, constriction at the waist as in bending action, and tight neck bands, are familiar ways of setting up or accentuating tinnitus which, of course, normally lasts no longer than the causative procedure. Contraction of the tensor tympani and stapedius muscles, which in some persons may be accomplished at will, will set up definitely recognizable tinnitus but the exact mechanism is still uncertain.

It is common clinical knowledge that certain disorders and diseases of the ear are more closely associated with tinnitus than others. Severe nerve deafness, sudden or in rapidly progressive stages, or in temporary or recurrent exacerbations, even though it reach totality for speech, is usually accompanied by severe tinnitus. This tinnitus is due to irritation from the degenerating or temporarily embarrassed nerve tissue. Pure obstructive deafness, even otosclerosis, if it does not involve the neural mechanism, may or may not give a history of tinnitus. Environment, age, rate of progression and the indvidual psychologic reaction greatly influence the tinnitus. People with chronically discharging ears are often, and in fact usually, free from severe tinnitus, as are those who have undergone radical operations unless the latter's ears heal with thick adhesions about the windows of the labyrinth. When a chronically involved ear is discharging, the hearing is usually better than when the ear ceases to discharge, and such improvement in itself

increases morale, lessens nervousness and aids in diminishing the disturbances causing the tinnitus, thus bringing it down to subaudible levels. Of course, this does not mean one must not try to produce healing of the suppurating ear. The personal reaction greatly affects the annoyance from any tinnitus which may be present. Apparently identical lesions may or may not cause the same or any tinnitus.

In addition to certain cranial nerve syndromes the conditions associated with nonvibratory tinnitus are: impacted cerumen; imperfect functioning of the eustachian tube; acoustic trauma; nerve deafness; obstructive otitis media and otosclerosis; poisoning from drugs, stimulants and narcotics; cardiovascular disorders; abnormal blood pressure; intracranial arteriosclerosis; gastrointestinal disorders; jaundice; psychoneurologic disturbances; allergic states; variations in the auditory vascular tree; involvement or disturbance through the otic, gasserian and geniculate ganglions; intracranial growths.

Directly or indirectly all of these conditions affect the blood and lymph supply to the auditory neural elements or their supporting tissues. Locally they may cause edema or may diminish the nutritional supply or the removal of tissue wastes. Stretching or tearing of the neural elements may result; there may be microscopic hemorrhages, disturbances of pressure or of water balance, changes in p_H or toxemia. Any of these incidentally produces edema and a lack of oxygen in the tissues, and because of this, an impending or actual degeneration of the neural elements in the order of their sensitiveness to the factors encountered.

Even though one unearths the cause of tinnitus, it does not necessarily follow that one can remove it; it does follow that one can manage it more intelligently. One can take steps to prevent its exacerbation. One can take steps to control the psychosomatic disorders accompanying and influencing it. Even though the physician only helps the patient to tolerate it, this aids in hearing and diminishes the annoyance from the tinnitus.

Tinnitus often diminishes and other annoying aural sensations may wholly disappear after disease of the ear reaches a stabilization stage. The deafness, the tinnitus and the other disturbances are then accepted as a finality and are less and less annoying, whereas in early or progressive stages of aural disorders they tend to increase in severity. Knowledge of these facts aids the physician in his management of the patient.

If one accepts the all or none theory of ne action, it follows that a certain number of ne elements must be activated to cause an au sensation. This holds good for the neural sponse resulting in tinnitus as well as for neural response resulting from actual mecha vibrations. If too few elements are irrita there is no sensation, and the tinnitus may t be said to be subaudible, though it may stil present in somewhat the same sense that so is still present when its vibrations are subaud

THE MASKING AND THE MEASUREMEN OF TINNITUS

When tinnitus is audible to the patient, usually realizes whether or not it is easily s dued or masked out by environmental noi He may tell the otologist, "I do not hear tinnitus in a noisy place," or "I do not hea in the daytime, I hear it only at night, pa ularly when I am in bed," "It is worse in country," and so on. All of his statements i cate that the presence or the absence of envi mental noise can be a determining factor changes in the loudness of his tinnitus. Tinn may be subaudible under average condition noise and quite audible under conditions of rounding quiet.

It will be noticed that I am repeatedly m tioning subaudible tinnitus. I am aware this has never been considered of importanc in fact, it has never been considered at all— it is of importance because it takes less chosomatic disturbances to bring a subaud tinnitus above threshold than to produce it novo. In other words, many direct and re influences, such as those of excessive noise, m cular or nervous tire or exhaustion, lack of sl family and business worries and maladjustme may not wholly account for tinnitus, but t certainly can and often do bring it to the when it is lurking in the background in a audible form. I believe that unless there is s irritation already present (i. e., subaudible nitus) no trivial emotional or somatic epis will by themselves cause tinnitus, at least las tinnitus. These considerations are impor from the standpoint of prevention and treatm

As I have shown many times, the effect masking sounds on tinnitus varies considera depending on which sounds are used for mask the tinnitus, but generally speaking environme noise will mask tinnitus in the same way it masks the hearing of similar actual sou

Of course, all masking sounds affect tinn to some extent, but the masking is trivial un

frequencies of the tinnitus and the masking nds are close. A most efficient way of mask- tinnitus experimentally is to use a thermal se, because such a noise may be measured in ibels, and is an over-all sound which con- s all frequencies at nearly equal intensities r a wide range. It should include the fre- ncies from 64 to at least 12,000.

Masking is most efficient when the masking quency is below and near the frequency it o mask. It follows that when the tinnitus very high sound, like escaping steam, it is easily masked by low frequency sounds, such hose from the street and the general environ- nt. However, an adequate thermal noise will ally mask these higher frequency steam sounds the like very easily if its intensity is equal to slightly above the intensity of the sensation g masked. But even the thermal noise is of stionable value when used to measure the dness of tinnitus unless it surely covers the quency band of the tinnitus.

have determined that there are some forms nonvibratory tinnitus that are difficult or im- sible to mask even with the loudest sound e loudest thermal noise) one can bring to r, and this in spite of the fact that the loud- s of the tinnitus measured audiometrically y be not over 5 or 10 decibels. This type of nitus often covers a broad band of frequencies. fact, it often sounds just like a thermal noise. other phenomenon I have noticed is that in e cases the masking noise seems to bring tinnitus into more prominence, making it n louder in the presence of the masking noise. order to account for the phenomena of diffi- masking I have set up the hypothesis that type of tinnitus (difficult to mask) arises ast in part in the central neurons or central lei instead of wholly or at all in the end an in the cochlea. It is difficult as yet to ve this hypothesis because few, if any, at opsy examine the central nuclei to find out ether and to what extent these are involved nerve deafness, let alone tinnitus.

I can see no reason why nonvibratory tinnitus various frequency combinations cannot be set in the central neurons, because a spatial angement of the auditory nerve fibers and lei is maintained in the tuberculum and even higher levels (the mesial geniculate ganglions), lesions anywhere along these pathways may up disturbances in a manner similar to that erved in those set up in other sensory tracts. elieve that otologic research has been con- trated so much on the middle ear, the cochlea and Corti's organ that the central nuclei and tracts of the auditory neural mechanism have been largely neglected. Herein lies almost a virgin field for research.

MEASURING THE FREQUENCY AND THE INTENSITY OF TINNITUS

Of first importance in the examination of the patient is an estimation of the character and the severity of his symptoms, of the sensations of which he complains. Fortunately, otologists now are able by audiometric examinations made in a properly sound-proofed room to determine definitely the threshold of hearing, i. e., what intensities of sound the patient cannot hear, and, by the use of sounds well above threshold, what sounds he can hear, and how loud and clear they seem to him.

To measure the character or the timbre of tinnitus one compares it with similar sounds until a sound is attained which simulates it in quality and intensity. If the tinnitus has a tonal quality, the procedure is to let the patient listen to a very high tone, say between 8,000 and 12,000 cycles, and then to a low tone, say between 64 and 128 cycles, and ask him if the former is above, and if the latter is below, the frequency of his tinnitus. (It usually is.) Then as the bracketing of high and low testing frequencies is gradually brought closer and closer, the patient will be able to determine within narrow limits the frequency which corresponds closest to that of his tinnitus. In determining the frequency of tinnitus it is important to employ intensities corresponding closely to the intensity of the tinnitus.

To measure the intensity of the tinnitus one applies a sound similar to the tinnitus in the opposite ear, and balances it in loudness with the tinnitus. This is usually accomplished without much difficulty except when there is neural deafness in the opposite ear, in which case "recruitment" causes even very small changes in loudness to appear greater than in normal ears or ears with conduction deafness, and the result is great fluctuations in loudness with slight changes in intensity. It may be necessary to mask out the one ear to be sure that it does not hear the testing tone applied to the other ear. If one cannot produce a sound of the same character as the tinnitus, a sound as near to it as possible may be used, and the number of decibels above the threshold required for the testing sound to balance or equal the loudness of the tinnitus may then be determined. This number of decibels will be the measurement of the loudness of the tinnitus.

MANAGEMENT AND TREATMENT

It is important to measure tinnitus not only for accuracy of immediate observations but for comparison with subsequent observations. It is also important to measure tinnitus because of the psychol[o]gic effect it imposes on the sufferer. When a patient has given a history of unbearable tinnitus and one demonstrates to him that it really is only 5 or 10 decibels loud, a factual foundation has been laid for management and treatment. One has enabled the patient perhaps for the first time to realize the true severity of the symptom. In the great majority of instances if he is made to realize that he is overestimating its severity, this realization will diminish his annoyance considerably and in many instances will go far toward alleviating conscious or subconscious fears of impending auditory or mental disaster. Let the otologist not take the attitude that because there is no likelihood of removing the lesions causing the deafness, the factors determining the tinnitus cannot be removed. Deafness and tinnitus may be coincidental but etiologically far apart. By all means treat the lesions and disorders causing the deafness, but also treat the lesions and disorders causing the tinnitus.

The facts and the hypothesis I have set forth provide only part of the tools used for the comprehensive medical and otologic examination that should be made. In carrying out these examinations there are many pitfalls and much persistent misinformation that must be avoided. I will mention only a few.

No part of the ear should be thought of as an independent entity. Every part is intimately connected with and often influenced by every other part. If the eustachian tube is even slightly blocked by tissue or by mucus, this blockage will affect the blood and the lymph vessels throughout the middle ear and its contiguous spaces. It may, and sometimes does, affect the blood vessels and therefore the nutrition of the labyrinthine windows and their contents. In some instances it will affect the circulation deep in the promontory bone. If these effects are prolonged, permanent disorders develop. There are many, at first thought trivial lesions, which may and often do have far reaching effects.

The eustachian tube is frequently implicated in the causation of tinnitus. The usual methods of testing for patency of the eustachian tube are misleading. It is customary for an examiner to determine patency by politzerization or by catheterization inflations, and if the patient does not feel or hear, or the examiner does not hear through his auscultation tube, the air enter the ear, the tube is put down as obstructed, as fact it well may be, but not necessarily so. reverse is also true. The tube may be he to inflate and still not be functioning norma

I encounter many instances in which neit the patient nor the examiner can hear an in tion and yet with a magnifying otoscope drum may be seen to move easily and extensiv with the slightest application of air pressure the nasopharynx. It often inflates more ea with gentle than with forceful pressure, beca the former interferes less with the movem of the muscles of deglutition.

Adhesions may prevent detection of movem of the drum membrane and yet the tube n be quite patent. A sure indication of function of the eustachian tube is to see a drum membra retract during Toynbee's experiment and resu its former position when the patient releases nose and swallows again. Under these conditi the tube is functioning under the handicap o partial vacuum in itself and the middle ear spa Unless a tube can function under these con tions, it is not functioning normally.

A very small amount of mucus in the eustach tube can interfere with proper ventilation e though air may bubble or seep through it either direction from time to time. When tu conditions are a factor in the production tinnitus, as they often are, treatments once week or two or even three times a week n fail in their objective because they are too in quent. Office treatments must then be supp mentetd with treatments by the patient at ho When home inflations are indicated I use little rubber balloon inflator which I introdu thirty-five years ago. It has been of great s vice. In the beginning, after gentle inflation my office I prescribe that it be used three four times before and after meals and on aris in the morning and at bedtime—in some ca in the middle of the night. The object is avoid the return of the blockage or a negat pressure in the tube and middle ear. As tube improves in function, the gentle inflati are required at lengthening intervals. These loons when properly made have the virtue avoiding harmful effects; they are so soft a elastic that with ordinary care they exert over 20 mm. of pressure in the middle ear.

Roentgen and for the last two years ra irradiation of hypertrophied lymphoid tissue and about the eustachian tubes have proved be of real value in many children, and this tre ment when indicated should supplement the s gical removal of these hypertrophic tissues.

serve my radium eustachian tube bougie (and bougies) for very resistant conditions.

I have mentioned no simple cure because there no panacea for tinnitus. I have used all of drugs exploited for this purpose, without convincing results, but any medication which is in controlling the underlying or contributing causes of tinnitus and in reestablishing confidence, a sense of well-being and a more healthful emotional response is useful; hence the use of barbiturates, nicotinic acid, bromides, chloral, atropine, potassium iodide and other drugs.

Otologists have as yet few drugs or manipulations which directly control degeneration of the auditory neural elements, but antisyphilitic and antituberculous treatments are, if properly used and in time, of real value. The vitamins and all the so-called cures have been of little or no use in the treatment of tinnitus. Sometimes they have made it worse. When an endocrine gland is deficient, the administration of the endocrine product or substance is clearly of benefit in many instances. No drug alone suffices. However, few patients fail to respond to the combined management, treatment and philosophic handling outlined in this paper.

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ATMOSPHERIC PRESSURES IN THE NASAL FOSSA, THE MAXILLARY SINUS AND THE TRACHEA

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A study of atmospheric pressures in the respiratory tract is not new. In the literature I was unable to find any series or group of collected readings of pressures taken. Unfortunately, much of the work has been done on cadavers and mechanically devised apparatus. One finds sufficient theories but few data to substantiate them.

The first part of this paper will concern itself with a series of readings of the changes of atmospheric pressure in the nasal fossa. One of the earliest writers on this subject was Donders.[1] He plugged one nostril with a piece of tubing and, with the mouth kept closed, took readings for gentle and forced respiration. He stated that the inspiratory or minus pressure averaged — 9 to — 10 mm. of water, while the expiratory or plus pressure measured + 7 to + 8 mm. He assumed the pressure to be the same throughout the respiratory tract. In a later [2] study he stated:

> . . . The maximum of expiratory pressure is also greater after thoracic than after abdominal pressure [breathing]. In myself I find for the former 86, for the latter 71 mm. of mercury. The negative pressure in the effort at a fully forced inspiration amounts in the former to 64, in the latter to 62 mm. These experiments were made with a manometer through an elastic tube brought into connection with one of the nostrils while the other was closed.

Braune and Clausen [3] measured the atmospheric pressure in the nasal fossa and the maxillary sinus, using a 60 year old male cadaver, a piece of tubing being thoroughly sealed into the trachea. A healthy young man held this tube in his mouth and breathed through it into the cadaver's trachea, and readings of the various pressures in the latter were taken. Their conclusion as to the changes of atmospheric pressure in the nasal fossa was that normal breathing g readings of — 10 mm. to + 5 mm. of wa while forced breathing gave variations of — to + 35 mm. of water.

Hunter,[4] using a water manometer for m suring gentle respiration, found that

> . . . in gentle respiration we have a negative pres on inspiration of from — 4 to — 16 mm. of water on expiration a plus pressure of + 1 to + 10 mm water.

He did not give the number of subjects tes nor did he cite any specific cases.

At about that time Proetz [5] concluded with a cannula midway back in the nasal fo the variation was 4 to 7 mm. plus and mi with a total fluctuation of 10 mm. He had group or series of patients to show the poss variation. Instead, he wrote:

> A glass and rubber model was now constructed means of which the patency of openings representing ostium, the nostril and the choanae could be contro The twin manometers (one in nasal fossa and on maxillary sinus) were adapted to these. With model it was possible to duplicate the observat made in the nose, which were as follows: [T pertaining to the nasal fossa will be quoted now the remainder later.]
>
> 4. On restriction of the nostril alone the peak p sures, both plus and minus, for a given respiration increased in both the nasal fossa and the sinus.
>
> 5. On restriction of the choanae alone the peak p sures, both plus and minus, for the same respira were reduced in both the nasal fossa and the sinus.
>
> 6. On restriction of both the nostril and the cho the pressure varied between wide extremes in di proportion to the relative restriction.

If by "restriction" he means closure of opening, the fourth conclusion is true and fifth is not, as judged by my findings. As the sixth, I can attempt no answer.

FIRST STUDY: A COMPARISON OF PRESSURES IN THE NASAL FOSSAE BEFORE AND AFTER SHRINKAGE OF MUCOSA

Procedure.—In the present investigation a U water manometer calibrated in half centimeters

This study was done at Camp Endicott, Davisville, R. I., with the help of Navy personnel.

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3. Braune, W., and Clausen, F. E.: Die Nebenhöhlen der menschlichen Nase in ihrer Bedeutung für den Mechanismus des Riechens, Ztschr. f. Anat. u. Entwcklngsgesch. **2**:1, 1876.

4. Hunter, R. J.: Study of Physics of Ant Laryngoscope **42**:163, 1932.

5. Proetz, A. W.: Some Intimate Studies of N Function, Ann. Otol., Rhin. & Laryng. **41**:125, 1932

ed. One arm of the manometer was connected to a ce of rubber tubing which was attached to a thin- lled metal cannula 3 mm. in diameter, as illustrated figure 1. All readings were taken by me except se in the case of subject 3, which were taken by a ined assistant.

The procedure used was to insert gently the metal nula into the nasal fossa at about its midportion. At es it was necessary to manipulate under a ridge a spur, or to compress a swollen turbinate, and then t a minimum of three to four respirations until the dings had become consistent and regular. Pain, fear, hs or forceful breathing vitiate a reading. The sub- t was instructed to relax, not look at the manometer l breathe regularly and gently. The readings were be those of a man at rest with gentle regular athing. One realizes that a reading of 1 or 2 mm.

Analysis of Findings.—From the 110 readings taken in each nasal fossa we found that:

1. The readings for the right side were generally similar to those for the left side except when there was a marked discrepancy in air space between these two sides.

2. The average for 220 recordings is an expiratory or plus reading of 1.5 mm. and an inspiratory or minus reading of 5.6 mm.

3. The expiratory or plus pressure in all these readings was less than the inspiratory or minus phase except in 2 instances, and in those the plus and the minus pressures were equal.

BLE 1.—*Averages for Readings of Intranasal Atmospheric Pressures Before and After Shrinkage of the Mucosa*

Reading (Before or After t Shrinkage)	Both Nostrils Open				Opposite Nostril Closed				Comment
	Right		Left		Right		Left		
	+	−	+	−	+	−	+	−	
Before	1.0	7.2	0.8	5.8	2.7	11.1	2.3	10.0	Both plus and minus pressures are greater in right nasal fossa with both fossae open or with alternate closing
After	...	...	...	...	...	....	...	....	
Before	0.9	4.9	0.6	4.1	3.7	12.0	3.1	9.9	All right side pressures are greater in both phases
After	...	...	...	...	...	....	...	....	
Before	1.0	5.2	1.4	5.1	3.3	11.2	4.7	11.3	The left side expiration or plus phase is greater open and closed; this difference levels off with shrinkage
After	1.6	3.0	1.0	4.0	4.0	7.0	4.0	7.0	
Before	0.9	4.7	1.3	5.1	3.3	9.7	2.6	8.3	All readings are reduced and balanced with shrinkage
After	0.0	2.0	0.0	2.0	1.0	4.0	1.0	4.0	
Before	4.3	10.8	3.8	8.3	9.9	20.8	6.5	18.0	Right inferior turbinate frequently edematous; expiratory and inspiratory pressure are greater in right, but these are reduced with shrinkage
After	2.2	9.0	3.2	8.0	4.0	10.6	4.0	13.2	
Before	1.5	6.8	1.9	7.7	5.6	16.2	5.9	18.6	Pressures are greater in both phases on left side even after shrinkage
After	1.0	5.2	1.4	7.0	3.6	12.0	4.7	14.0	
Before	0.9	5.1	0.6	4.3	4.7	13.6	3.2	12.3	Before shrinkage right side pressures are higher in both phases diminishing with shrinkage
After	0.5	3.0	0.5	4.0	1.2	5.3	1.0	7.3	
Before	1.3	6.5	1.6	6.7	2.4	9.7	2.8	10.3	Slight increases on left in both phases
After	1.0	5.1	1.1	6.2	1.7	8.5	2.1	9.7	
Before	2.4	3.9	2.4	4.1	3.2	7.1	3.9	9.5	Slight increases on left in both phases; disappears with shrinkage
After	1.6	3.0	1.4	3.4	2.3	4.6	1.7	5.0	
Before	0.6	5.2	0.5	5.0	2.6	11.4	2.3	10.9	Almost balanced readings
After	0.4	3.7	0.3	3.6	2.1	8.0	1.4	7.0	
Before	0.6	4.2	0.5	4.0	3.8	11.3	1.3	8.3	Blocking off left side before shrinkage produced marked variation in right; with shrinkage this is lost—all readings level off. Generally the right inferior turbinate was edematous
After	0.6	3.0	1.0	3.0	2.0	7.3	1.6	8.0	

erence at one time means nothing. However, a sistent difference of 1 or 2 mm. in a series of read- is to be taken as accurate, as our experience showed. he study was done on 11 men aged 19 to 41, the rage age being 27 years. Daily readings were taken hese subjects for ten successive days. The readings sisted of one for expiration, or the plus phase, wed by one for inspiration, or the minus phase. ile the cannula was still in the nasal fossa, the osite nostril was compressed, closing off this fossa pletely, and records made of the plus and minus dings under these conditions. The compression of nostril was an attempt to simulate atmospheric con- ns with one nasal fossa obstructed. It is apparent this is total blockage and is produced at the rnal nares. After readings had been taken on two subjects it was decided to shrink the nasal mucosa repeat the readings. A 0.25 per cent solution of ynephrine hydrochloride was used as a vasocon- tor, and after ten minutes had been allowed for nkage to occur, the same series of readings was ated. It is to be noted that all readings in all tables n millimeters of water.

When we took these same readings and averaged the pressure readings in each phase for each patient as in table 1 we found the following:

1. After shrinkage of the nasal mucosa there is always a lowering of inspiratory and expiratory pressure. Usually the drop is greatest in the inspiratory or minus pressure.

2. Following vasoconstriction there is a tendency toward equalization of the pressures in both nasal fossae. The greater the degree of shrinkage, or the more open the fossae are, the more will all pressures approximate each other, i. e., not only opposite sides but even the plus and minus readings.

3. When one nostril is closed, the pressure reading taken in the opposite nasal fossa rises, particularly if the latter is narrow or has a limited volume or air space.

4. An edematous inferior turbinate which did not completely occlude the fossa raised both phases of pressure on that side over the pressures of the more voluminous fossa.

For practical purposes one may say that shrinking of the nasal mucosa tends to reduce fluctuations of atmospheric pressure; conversely, greater readings for a fossa indicate a narrowing or a restriction of the air space in that fossa. Sternstein [6] came to a somewhat similar conclusion.

> . . . In the normal nose, the index, or amount, of shrinkage was found to be 35 per cent, in the partially obstructed nose 75 per cent and in the completely obstructed nose 90 per cent.

SECOND STUDY: A COMPARISON OF PRESSURES IN THE NASAL FOSSAE UNDER VARIOUS TYPES OF EXPERIMENTAL CLOSURE

Procedure.—Another experiment was made on several persons from the group used in the first experiment. Readings were taken in each fossa, which had been shrunk with neosynephrine, with both nares open. Then the manometer-cannula was put in one fossa and the nostril around the cannula thoroughly compressed around

TABLE 2.—*Readings of Intranasal Pressures Under Different Types of Closure*

Patient		Both Nares Open		One External Naris Blocked: Pressure with Cannular Side Blocked		One External Naris Blocked: Pressure with Opposite Side Blocked		Posterior Choana on One Side Blocked: Pressure on Blocked Side		Posterior Choana on One Side Blocked: Pressure on Opposite Side	
		+	−	+	−	+	−	+	−	+	−
4	Right	0	2	0	3	1	4	0	0	2	5
	Left	0	2	1	6	1	6	0	0	2	5
7	Right	0	2	2	10	1	4	0	0	1	5
	Left	0	2	1	5	3	13	0	0	2	11
8	Right	2	7	3	10	4	9	0	0	4	10
	Left	2	7	5	12	2	9	0	0	3	13
9	Right	3	4	5	8	4	6	0	0	4	6
	Left	2	5	3	8	4	7	0	0	4	6
10	Right	1	5	3	10	3	12	0	0	4	9
	Left	1	5	3	10	3	12	0	0	3	9

the cannula so as to close the vestibule on that side, and readings were noted. Next the vestibule of the opposite side was compressed with the cannula still in the original fossa, and pressures were recorded. Finally successive pieces of cotton were pushed as far posteriorly on one side as they could be without falling into the nasopharynx, until the posterior choanae on that side was completely blocked. The pressure reading on that side was naturally nil. Then a reading was taken on the opposite side, and all these readings were placed in table 2.

Analysis of Findings.—One sees in these 5 subjects that:

1. The occlusion of the posterior choana of one side increased the plus and minus pressure in the opposite nasal fossa. Naturally there is reading on the same side.

2. The pressure present in a nasal fossa which the vestibule is closed almost approxima that in the opposite nasal fossa the vestibule which is patent; i. e., pressures are equa throughout.

THIRD STUDY: A COMPARISON OF THE PRESSURE IN THE NASAL FOSSA WITH THAT IN THE MAXILLARY SINUS

Braune and Clausen [3] in their work with cadaver found that the pressure readings for antrum were +4 and −8 mm. of water normal breathing. They felt that the press in the antrum would at times be a fraction than that in the nasal fossa. This loss wa matter of a millimeter or two in gentle respirati but increased with forceful or deep respirati

Coffin [7] in his work on the pressure in antrum used a U tube with alcohol as the fl in the manometer. He had a conception t there was a fixed or static pressure in antrum. For the first group in his series recorded only a positive pressure; for the n 2 cases he gave a plus and a minus readi Regarding his series of approximately 25 ca he stated,

> It would seem that in all cases which were appare normal we found an average positive reading of cm. and in no case a negative pressure when respira was at rest.

He wrote further:

> In abnormal cases when air was not passing thro the nose there was an average positive pressure 1.53 cm.

This conception of a maintained pressure the antrum is poorly founded. Such a condit can be produced only in an antrum closed from the nasal fossa. Proetz [5] mentioned:

> In no case was it possible to demonstrate the posi pressure described by Coffin with respiration at so long as the ostium was open, that is a case in w the normal fluctuation occurred during respiration.

It cannot be too strongly stressed that taking readings of pressure there must be fluid either in the cannula or surrounding opening of the cannula when it is placed in nasal fossa in order to take an accurate readi The moment the manometer ceases to fluctu the observation means only one thing, viz., has ceased to flow into the manometer. Usu there is fluid in the cannula or more likely aro

6. Sternstein, H. J.: Nasal Obstruction in the Adult, Arch. Otolaryng. **25**:442 (April) 1937.

7. Coffin, R. A.: Experiments with Atmosph Pressure in the Maxillary Sinus, Tr. Am. Laryng. **44**:291, 1922.

distal opening; or further on into the cavity ere is a cessation of air exchange, e. g., rough the ostium of the sinus. This would rely happen when the cannula was in the nasal ssa. It did occur frequently in the maxillary us and occasionally in the tracheal catheter.

Hunter,[4] using a U tube water manometer, rote:

I then measured the pressure in the antrum by introcing a cannula through the lateral wall of the nose der the lower turbinate and found it the same as the nasal fossa. In antra in which I found the pres- differed from the pressure in the nasal fossa I nd that there was pus in the antra or that our tubes re blocked with a droplet of water; or, as in the tance of introducing an extra cannula into the antrum der the middle turbinate to simulate an accessory ium, as advised by McMurray, we were allowing mospheric air pressure to overcome the pressure in antrum.

specific cases or series of pressure readings re given.

McMurray,[8] about a year previous to Hunter's tement, wrote:

In a few instances neither the minus nor the plus ssure could be increased to a perceptible degree by ced or prolonged respiration. In two of these cases e large accessory openings were found posterior to infundibulum. It was assumed that the accessory enings with a normal ostium in the infundibulum were explanation of the more or less constant pressure in antrum regardless of the respiratory effort.

If the foregoing assumption is correct, a cannula ced in the antrum through the lamina membranacea uld either abolish or decidedly reduce the negative ure present in both ordinary and forced inspiration. was found to be true. It would thus seem that conformation of the hiatus semilunaris and the in- ibulum is the essential factor in the production of ative pressure, and that its effect is partially or rely neutralized by an accessory opening. Particu- y is this true if the accessory opening is quite large.

McMurray did not give any group or series of dings of his cases.

Schmücker[9] measured the atmospheric pres- e, using a glass model to simulate the nasal a and the antrum, and also patients, but he not cite any specific readings or any series ases. He gives the range of difference in the ctuations as from 6 to 32 cm. with a U tube water manometer. These are rather high dings. However, he does bring out a practical nt, viz., that if there is no fluctuation of pres- e reading in the sinus a roentgenogram should taken.

Proetz[5] in the work with the glass model concluded that:

1. So long as the ostium remains at all patent the pressure changes in the sinuses are identical with the pressure in the nose.

2. As the ostium narrows a progressively increasing time lag occurs in the fluctuation of pressure within the sinus, so that it requires an appreciable time for equalization of pressure on the two sides of the ostium to occur.

3. Regardless of this time lag, the peak pressures are not reduced until the ostium finally closes altogether, when they cease entirely.

He has no specific cases or series of pressure readings from the antrum recorded.

Several years later Judd[10] agreed with Proetz that the pressures on both sides of the maxillary sinus opening were equal.

. . . so long as there is even a small opening through the ostium the peak pressure in the nose will, after an interval, be equalized in the sinus.

In his article no specific cases or series of pressure readings from the nasal fossa and the antrum are given.

The hydraulic principle governing the flow of liquid or gas from one region to another is given in Bernoulli's theorem, namely: The total head at the upstream point is equal to the total head at the downstream point, provided there is no loss due to friction between the two points. By total head is meant the sum of the velocity, the pressure and the elevation head at a point. Of course, if both points are at the same level, the elevation heads cancel out.

Applying this theorem to the pressure found in the nose as compared with the pressure in the antrum, one should reason that:

First, the antrum with a normal canal or ostium in the floor or the lateral wall of the infundibulum ethmoidale has a passage which might be above or below or at the level of the average of air currents and eddies in the nasal fossa. It would be difficult to state whether there would be a loss in elevation head from air entering or leaving the antrum, there being so many anatomic variations of the nasal fossa.

Second, the constricting orifice at the infundibulum and the passageway leading into the antrum would increase the velocity and lower the pressure of the air going into the maxillary sinus. There would also be a loss of pressure as the air left the maxillary sinus to go into the nasal fossa.

Third, one is dealing with surface or contour irregularities; e. g., the uncinate process is almost a dam, and the bulla frequently obstructs the

8. McMurray, J.: The Intra-Antral Air Pressure dent to Respiratory Excursion and Its Effect on al Drainage, Arch. Otolaryng. **14**:581 (Nov.) 1931.

9. Schmücker, K.: Die manometrische Messung des austausches in der Kieferhöhle und ihre praktische eutung, Ztschr. f. Hals-, Nasen- u. Ohrenh. **30**:638, 0.

10. Judd, D. K.: Air Pressure in the Nose and Maxillary Sinus Under Normal Conditions and in Disease, Ann. Otol., Rhin. & Laryng. **51**:689, 1942.

passage into the infundibulum. These all suggest frictional losses leading to reduced pressure of air going into the sinus, and when the air comes from the antrum into the nasal fossa there would be a lesser drop.

Next in this intricate system one must consider that the sinus with its approximate volume

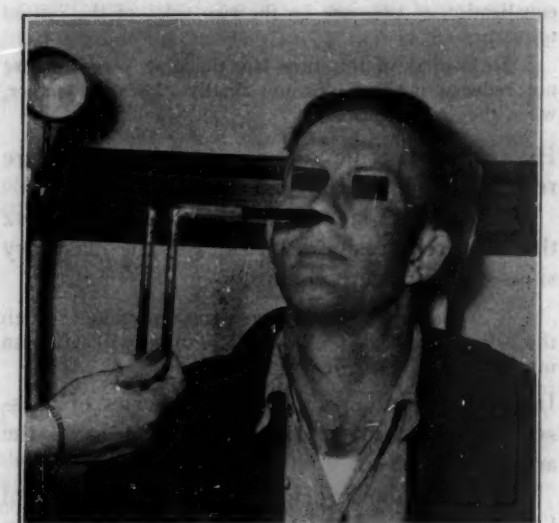

Fig. 1.—Taking a reading of atmospheric pressure in the left nasal fossa.

of 15 cc. would have practically no effect on the air pressure in the general respiratory circulation; i. e., it could not really increase the pressure in the nasal fossa, while there would be a perceptible drop from the pressure in the nasal fossa when air was hindered by friction or a converging passageway around the ostium in getting into the antrum. In a rough way one would conclude that as regards a sinus with a limited passageway or ostium the air going into the antrum should show a slight loss of pressure in this cavity. One feels that the alteration of inspiratory and expiratory pressures reaches a peak in the nasal fossa and that this force is not transmitted rapidly enough to the antrum before it starts to reverse itself with a slight loss of peak in the antrum.

Again one may find an accessory passageway or ostium leading into the antrum. This opening would completely alter the pressure findings in accordance with its height above the air currents, its size, its contour and the approach to it. It generally would help air to enter the antrum more freely and therefore help to equalize the pressures in the nasal fossa and the antrum.

One can readily understand that a glass model is a poor means of judging the pressure changes which take place in the maxillary sinus with its variability of connections and approach to these connections from the nasal fossa. Nor is such model an accurate duplication of the conditio in the nasal fossa with its projecting "wi breakers" of turbinates and ridges on the septu which produce air currents and loss of "wind

Procedure.—When it was decided that an antr required a puncture, a reading of pressure in the na fossa was taken after the inferior meatus had b cocainized. Following the puncture, the manome was attached to the cannula, provided no pus drip from the opening, and a reading was attempted. N the antrum was examined antroscopically with a spe short lamp antroscope to determine the pathologic c dition of the mucosa, which was recorded. When pus was visible in the antrum, washing was not do Later it was decided to wash all antrums regardl to determine the amount of pressure required to fo isotonic solution of sodium chloride through the si passageway. After the wash the saline solution maining in the antrum was aspirated thoroughly wit special narrow cannula which slipped through the ou cannula. The patient's head was arched back in extre extension with a slight tilt to the washed side as sho in figure 2. Finally, long thin cotton applicators w introduced through the cannula to dry the ca thoroughly and to determine if there was any sa solution in the sinus. Then a second reading of mospheric pressure was taken to determine whet there was a free exchange of air between the n fossa and the maxillary sinus or antrum. Fina various sulfonamide compounds in the form of pow were blown through the cannula into the antrum pro

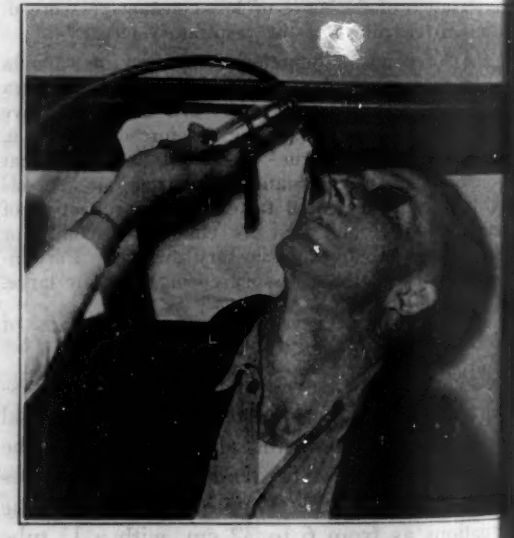

Fig. 2.—Aspirating saline solution from the antrum after irrigation.

Early in the work the readings from the maxil sinus were taken subsequent to those from the fo As one can understand, a difference of 1, 2 or 3 mm. would be undetectable since each gentle resp tion could vary that much and more. It was esse to get the patient calm, and even then it was ne sary at times to strike an average of a few millime variation in several different readings. Later it realized that to state accurately the comparative tionship of pressures in different spaces in the respira tract the readings must be taken synchronously.

TABLE 3.—*Comparison of Atmospheric Pressures in the Nasal Fossa and the Antrum*

Subject	Nasal Fossa *		Antrum Before Wash		Antrum After Wash		Pathologic Condition of Antrum and Comment
	+	−	+	−	+	−	
1	1	4	0	0	0	0	8 cc. of pus aspirated; almost equal quantity washed out; mucosa markedly congested throughout; pus clinging to lateral wall after irrigation; ostium seen, but edema marked in this area
	1	4					
	3	3	3	3	0	0	This is third wash; minute amount of mucus washed out; mucosa still edematous; could not get reading after wash; probably opening is very small and saline solution or edema closed it off
	3	3					
2	2	5	..	..	..	..	A fistula extends from left upper 2d molar socket into antrum; 10 cc. of pus washed out with pressure, only 75 mm. Hg
	2	5	0	0	2	5	
	2	2	..	..	..	..	This is fourth wash; all readings except this and first gave no pressure in antrum; ostium can be seen between 2 polyps
	1	2	0	0	2	2	
3	6	8	..	..	..	..	Few specks of pus washed out; mucosa is edematous throughout, with a polyp in ostial area
	4	5	0	0	0	0	
4	3	3	3	3	3	3	One "gob" of about 0.5 cc. pus; mucosa slightly thickened, with minute polyp superiorly; free flow of saline solution with pressure 75 mm. Hg
	3	3					
5	4	4	..	..	..	..	Washed out 10 to 15 cc. of pus; 1 cm. polyp on floor and on roof
	3	4	0	0	0	0	
6	1	1	..	..	..	..	3 cc. of mucoid discharge washed out; slight edema of mucosa
	1	1	2	2			
7	5	5	..	..	..	..	Small amount of pus in left antrum; two small polyps visible superiorly; required pressure 300 mm. to wash
	5	5	0	0	0	0	
	3	5	..	..	..	..	Practically no pus; mucosa edematous; did get a temporary reading, which disappeared sometime after wash
	2	4	0	0	3	3	
8	1	3	..	..	..	..	Two strands of pus washed out; another still clings to antral wall after wash; ostium is seen superiorly; a polyp is seen, with a second on floor, sloughing surface
	1	3	0	0	3	3	
9	1	3	..	..	..	..	About 2 cc. of pus washed out; mucosa is thickened throughout, particularly in ostial area; required pressure 200 mm. Hg for wash, even after 4 washes
	4	4	0	0	0	0	
10	3	3	0	0	0	0	About 5 cc. of gelatinous mucus washed out; mucosa markedly edematous; second wash gave no reading and very little pus
	4	4					
11	5	5	..	..	..	..	Aspirated 15 cc. of pus; numerous polyps present; after third wash had only 8 cc. of pus but no reading was obtainable
	5	5	0	0	0	0	
12	3	3	..	..	..	..	Small plug of mucus washed out; reading readily obtained after saline solution was aspirated
	3	3	0	0	3	3	
13	0	1	..	..	..	..	"Window" into antrum present; about 3 cc. of pus washed out; required pressure 110 mm. Hg for wash
	0	2	0	0	2	4	
	0	2	..	..	..	..	This is third wash; practically no pus; required pressure 75 mm. Hg for wash
	0	2	0	2	0	2	
14	5	5	0	0	3	3	Small amount of pus washed out; second wash gave a reading; only after wash was one able to see a few polyps and an accessory ostium
	5	5					
15	0	2	..	..	..	..	About 3 cc. of pus washed out; mucosa markedly thickened; two 1 cm. polyps superiorly
	0	2	0	0			
	2	4	3	4	3	4	No pus present; one polyp seen on floor in addition to those superiorly
	2	4					
16	3	4	5	5	5	5	1 cc. of thick pus washed out; pressure of 110 mm. Hg gave free flow
	6	6					
17	10	15	0	0	0	0	Several cubic centimeters of pus washed out; mucosa markedly congested; three or four 1 cm. polyps present
	10	15					
	10	15	0	0	8	12	Aspirated 8 cc. of pus; antrum washed out with pressure 75 mm. Hg; obtained reading, which disappeared later
	10	15					
18	2	2	..	..	..	..	10 cc. of pus suctioned off; mucosa markedly edematous
	2	2	0	0	0	0	
	5	8	..	..	..	..	This is third wash; 3 cc. of pus and blood aspirated; required pressure 170 mm. Hg to wash; mucosa still edematous
	3	5	0	0	0	0	
19	1	2	..	..	..	..	Fistula into left maxillary sinus; three 1 cc. granulations over floor; moderate amount of pus
	3	4	0	0	0	0	
	0	3	..	..	..	..	This is fourth wash; about 5 cc. of pus present; required pressure 300 mm. Hg for wash
	3	4	0	0	0	0	
20	4	4	..	..	..	..	Several cubic centimeters of pus; marked edema and congestion of mucosa
	4	4	0	0	0	0	
	5	10	..	..	..	..	This is third wash; small amount of pus; mucosa still markedly edematous
	8	12	0	0	0	0	
21	7	10	0	0	0	0	Aspirated 10 cc.; had to use a cannula within a cannula to force saline solution, i. e., could not wash even with pressure 300 mm. Hg
	6	9					
	2	2	..	..	..	..	No pus visible after third wash; required pressure 100 mm. Hg for wash; could not obtain reading after wash
	2	3	3	3	0	0	
22	2	3	3	4	3	4	Speck of pus on lateral wall; mucosa on floor edematous; required only 60 mm. Hg pressure for wash
	2	3					
23	1	3	0	0	0	0	Small amount of free pus; mucosa markedly edematous; required pressure 300 mm. Hg, with only slow return
	4	5					
	2	5	0	0	0	0	This is fifth wash; practically no pus but still mucosa is edematous; ostium is seen as a slit
	2	4					
24	6	5	6	6	6	6	1 cc. of urine-colored mucinous discharge; slight polypoid thickening; ostium is seen
	7	5					
25	0	2	..	..	..	..	Caldwell-Luc operation 6 years ago—has a window; washed out 5 cc. of pus
	2	3	2	3	2	3	
26	3	5	..	..	..	..	No pus in antrum; mucosa shows only slight edema; pressure 110 mm. Hg gave good return flow; cannot explain why no reading in antrum
	4	6	0	0	0	0	
27	1	2	..	..	..	..	No pus in antrum; required pressure 60 mm. Hg for wash
	1	3	2	5	2	5	
28	2	2	..	..	..	..	No pus present; mucosa shows slight thickening; pressure 60 mm. Hg for good return flow
	3	4	3	4	3	4	
29	2	4	2	4	..	..	No pus present; no wash done; ostium seen
	2	4					

* The upper reading for each subject is that for the right fossa; the lower, that for the left.

TABLE 3.—*Comparison of Atmospheric Pressures in the Nasal Fossa and the Antrum—Continued*

Subject	Nasal Fossa *		Antrum Before Wash		Antrum After Wash		Pathologic Condition of Antrum and Comment
	+	−	+	−	+	−	
30	1 1	5 5	0	0	0	0	No pus; mucosa mildly edematous; required pressure 170 mm. Hg wash; probably edema around ostium
31	8 12	8 8	0	0	3	3	No pus; however, got a reading after wash
32	10 15	14 25	.. 4	.. 6	..	..	No pus in antrum; widely patent ostium visible; no wash even don
33	0 0	2 2	0	2	..	..	No pus visible; slightly hyperplastic mucosa; washed with pressure 60 mm. Hg
34	3 3	4 4	2	3	3	3	No pus present; large patent opening, probably an accessory ostiu
35	2 2	1 2	.. 0	.. 0	.. 0	.. 0	No pus present; there is general edema; required pressure 150 mm. to wash
36	2 2	3 3	.. 2	.. 3	.. 0	.. 0	1 mm. fistula from left upper bicuspid into antrum; no pus pres no thickening; could not obtain reading after wash
37	0	3	1	3	1	3	No pus present; slight hyperplastic changes in mucosa; pressure mm. Hg for wash
38	12 5	18 7	.. 5	.. 5	..	..	Antrum clear; no pus; no wash
39	3 3	6 6	3	6	3	6	No pus present; slight hyperplasia of mucosa; pressure 60 mm. H required
40	2 3	4 5	.. 2	.. 4	.. 2	.. 4	No pus present; piece of dry crust on na cantral wall; free flow pressure 60 mm. Hg
41	3 2	4 3	.. 2	.. 3	.. 2	.. 4	No pus in antrum; ostium is clear; pressure 60 mm. of Hg for wa
42	8 10	12 14	.. 3	.. 7	.. 3	.. 7	No pus visible in antrum; slight hyperplastic mucosal changes; sure 60 mm. Hg used in wash
43	6 5	5 5	4	4	4	4	No pus present; small polyp superiorly; pressure 60 mm. Hg requ to wash
44	2 2	4 4	.. 2	.. 4	.. 2	.. 4	There was an opening in inferior meatus from previous puncture; mal opening also present; no pus; mucosa hyperplastic; pressur mm. Hg for wash
45	4 1	4 4	1	3	1	3	No pus present; slight hyperplasia of mucosa; pressure 60 mm. for wash
46	1	5	1	4	1	4	No pus present; pressure 60 mm. Hg for wash
47	2	5	1	3	1	3	No pus; mucosa pale throughout; washed out readily with pres of 60 mm. Hg
48	1	5	2	4	2	4	No pus; slight hyperplasia of mucosa; washed with pressure 60 mm.
49	12	7	10	7	10	7	No pus; this is only patient seen who had greater pressure in plus in minus phase; he seemed to blow air out of nose
50	3	10	2	8	2	8	No pus present; some hyperplasia present; pressure 60 mm. Hg to

fortunately, this was done with only the last 10 of the antrums (subjects 41 to 50). However, all the readings for the trachea and the nasal fossa were taken concurrently. It should be mentioned that it is somewhat difficult at times to take simultaneous readings. A comparison of the pressure in an antrum with that in the nasal fossa requires two cannulas through one nasal fossa. Both manometers must be fluctuating and matched side by side to demonstrate the differences, often requiring prolonged patience.

The group studied consisted of men from 19 to 48 years of age, the average age being 32.

Findings.—From a perusal of the results recorded (table 3) for the first 40 subjects I concluded that the pressures in the antrum and the nasal fossa are equal. However, on going over the results recorded for the last 10 subjects I think this not the exact truth. The pressures in the antrum and the nasal fossa, I believe, are often equal, as Proetz and Judd have stated, but I think that frequently the antral pressure is just a little less, both plus and minus, than the pressure in the nasal fossa; also, as Braune and Clausen showed, this is more pronounced in forceful breathing. With a manometer in the nasal fossa and another the antrum one will in the majority of the cas not in all, be able to detect a slightly less deg of pressure in the antrum. If one wishes exaggerate the difference, one asks the pati to breathe deeply, just as was stated by Bra and Clausen with regard to a cadaver m years ago.

It must be reiterated that the difference actual pressure is only a matter of a millimeters of water, which, as actual pressu go, is insignificant, and it disappears with a la opening or with accessory openings to the ma lary sinus.

I found that whenever there was a la opening or, better yet, an accessory passage or an operative "window" into the antrum would generally get a fluctuation of pressu Hunter and McMurray reasoned that they not get any readings in some cases because th was an accessory ostium, but that is not in agr ment with my findings. I conclude from findings in cases such as 25, 34 and 44 that

re openings into the antrum the more certain is the antrum will have a pressure similar to t in the nasal fossa. In fact, if the nasoantral ll were removed, it would have the same pres- re reading as the nasal fossa.

Another point noted was that the greater the ssure required to force saline solution through wash system the more difficult it was to ay powdered sulfonamide compounds into the trum—in some cases it was practically impos- le. In some cases one would get a transitory ssure reading which would disappear with a respirations. If the ostial passageway is matous or almost closed, a "gob" of mucus a drop of saline solution will complete the sure and readings will cease. At times blow- a blast of air would force the passageway r, occasionally causing slight hemorrhage. reful breathing with the opposite nostril com- ssed often did as well, removing the factor of morrhage. It was interesting to note the rn of pressure in antrums of patients who e improving.

Analysis.—If one breaks down all the figures those for antrums showing pus and those antrums without pus and under each of these, those for antrums giving a pressure and e for antrums not giving a pressure, one ls:

Of the 25 antrums (subjects 26 to 50) ing no pus present, all but 3 gave a fluctua- in pressure. Of the 3 that did not give a ssure differential, 2 had edema of the mucosa, bably involving the infundibulum or the al area.

Of the 25 antrums (subjects 1 to 25) ing pus present, only 13 gave a pressure ation. Of these 13 there were 6 which gave ading after one or more irrigations. Another d small amounts of pus, estimated at 3 cc. or The remaining 2 had a "window" from a vious operation.

Of the 12 antrums which gave no pressure tuation, all but 2 contained 5 cc. of pus or e. In the 2 which did not have pus there was ked mucosal edema.

t is apparent that if one obtains a variation in ssure reading from an antrum it means that e is an avenue for drainage and little or no present. However, if there is a "window" an accessory ostium above the "fluid level," may get a reading even with pus in the rum.

ne can recheck or gage the degree of obstruc- to drainage by taking the pressure required force the saline solution through the wash system. With the wash bottle placed at approximately the level of the patient's head and using tubing about 5 feet (152 cm.) in length to the antral cannula, the pressure required to force the saline solution to return through the sinus varied from 60 mm. to over 300 mm. of mercury. (The pump gage read from ¼ to 4 pounds [113 Gm. to 1.8 Kg.]). In all antral irrigations in this work, a bottle was used connected to a pump system which was readily regulated by an outlet valve for the amount of pressure required. The less pressure required the more patent was the canal or opening from the sinus to the midmeatus. Pressures over 300 mm. of mercury would rarely be tolerated, the patients complaining of a painful sensation of pressure usually beneath the eye, at times in the cheek.

Once in this series it was impossible to force the saline solution through on the first wash. A cannula within a cannula had to be used with sufficient air space between the two to allow for return flow. With the third wash it was possible to force saline solution through the system using a pressure of 300 mm. of mercury.

Using the setup described, I feel that pressures above 2 pounds (0.9 Kg.) or 150 mm. of mercury mean restricted flow. Pressures greater than this mean that drainage is limited and that the connecting passageway is constricted. I think one may say that the more constricted or narrowed the passage, the more poorly will the antrum drain, and it will get well slower, all other factors being equal.

In 1932 I reported that the passageway from the antrum to the infundibulum ethmoidale was generally a canal and not an ostium. After measuring a series of 100 antrums, I [11] stated in 1939 that the opening to the maxillary sinus was a canal in 83 per cent of the cases and that in this percentage the canal averaged 5 mm. in length. I further pointed out that this would tend to favor obstruction to drainage when mucosal edema set in. I feel that the practical importance of this fact is not fully realized.

FOURTH STUDY: A COMPARISON OF THE PRESSURE IN THE NASAL FOSSA WITH THAT IN THE TRACHEA

I was unable to find any literature with actual readings taken within the trachea or the bronchi. It seems to be the general opinion that the pressure within the nasal fossa is the same as that within the trachea or the intrapulmonic

11. Simon, E.: Anatomy of the Opening of the Maxillary Sinus, Arch. Otolaryng. **29**:640 (April) 1939.

area. Luciani [12] in his text on physiology wrote:

. . . In order to estimate these variations of intrapulmonary pressure it is only necessary to connect a mercury manometer with one nostril while the mouth is closed and to breathe with the other nostril (Donders). It will be seen that in quiet breathing the mercury column falls 1 mm. during inspiration and rises 2-3 mm. in expiration. The oscillations are increased in forced respirations.

Similarly, Howell [13] in his text, writing of intrapulmonic pressure, stated:

. . . Under normal conditions the fall of pressure during a quiet inspiration is not large. Donders determined it in man by connecting a water manometer with one nostril and found that it was equal to —9 or —10 mms. water. . . . In normal expiration Donders estimated this rise as equal to 7 or 8 mms. of water.

Macleod [14] also offered the same opinion in a more vague manner:

The pressure of the air in the respiratory passage is readily measured by inserting into one nostril a tube connected with a manometer; at each normal inspiration the manometer registers a negative (sub-atmospheric) pressure of 2 or 3 mm. Hg, and at each quiet expiration, a positive pressure of about the same degree. The same changes presumably take place throughout the air-bearing passages and spaces. If there is an interference with the free passage of air in and out of the lungs the changes in the intrapulmonic pressure may become much greater than this.

Best and Taylor [15] in their volume, writing of intrapulmonary pressure, said:

. . . The variations may be demonstrated by connecting one nostril with a manometer and breathing with the mouth closed. This pressure will be found to be —2 mm. Hg during the inspiratory phase and to rise to +3 or +4 mm. Hg during the expiratory phase of ordinary respiration.

Procedure.—Readings of intratracheal pressure were taken on patients sent from the medical department to have iodized poppyseed oil 40 per cent injected into the lung for the demonstration of bronchiectasis. The patient's larynx was well anesthetized to prevent coughing and a no. 14 or 16 French soft rubber catheter was introduced into the trachea for the injection. Just prior to the actual injection a reading of the pressure within the nasal fossa and of that within the trachea was taken via a cannula attached to the catheter. As mentioned earlier, these readings were taken synchronously. Occasionally, if the patient coughed, it was necessary to aspirate mucus from the catheter and then blow air through it to clear its passage.

12. Luciani, L.: Human Physiology, translated by F. A. Welby, New York, The Macmillan Company, 1921, p. 424.

13. Howell, W. H.: Textbook of Physiology, ed. 14, Philadelphia, W. B. Saunders Company, 1940, pp. 662 and 663.

14. Macleod, J. J. R.: Macleod's Physiology in Modern Medicine, edited by P. Bard, ed. 9, St. Louis, C. V. Mosby Company, 1941, p. 542.

15. Best, C. H., and Taylor, N. B.: The Physiological Basis of Medical Practice, Baltimore, William Wood & Company, 1939, p. 473.

Analysis of Findings.—A study of tabl points to the following conclusions:

1. The intratracheal pressures are alw greater than those in the nasal fossa both in plus and in the minus readings.

2. Frequently the expiratory or plus phas greater than the inspiratory or minus ph This is exactly opposite to the condition pre in the nasal fossa, where the inspiratory phas practically always greater.

3. The average for all readings of inspira or plus pressure in the trachea is 9.5 mm.; the readings of expiratory or minus pressure average is 9.3 mm. For this particular gr of 7 patients the nasal fossa readings aver plus 2.4 and minus 7.

TABLE 4.—*Comparison of Atmospheric Pressures i Nose and in the Trachea*

Subject	Age		Both Nasal Fossae Open				Opposite Nostril Close			
			Nose		Trachea		Nose		Trac	
			+	−	+	−	+	−	+	
1	46	Right	8	10	13	8				
		Left	8	9	15	10				
2	33	Right	3	4	12	10	4	7	14	
		Left	1	3	14	7	3	6	14	
3	36	Right	5	15	13	10	4	12	8	
		Left	3	11	9	8	14	10	8	
4	32	Right	1	5	7	6				
		Left	0	4	7	6				
5	33	Right	1	4	3	7	9	20	12	
		Left	2	4	4	7				
6	24	Right	0	2	2	4	2	3	2	
		Left	0	2	1	7	2	7	4	
7	18	Right	0	3	1	4	0	6	2	
		Left	2	6	3	7	2	8	3	
Averages.....			2.4	7	9.5	9.3				

The reason for the loss of pressure from trachea to the nasal fossa is due to loss of "h head," as already explained. However, ther another factor at work which does not permit minus phase to drop so sharply as the plus ph In fact, in subject 3 the minus phase was gre in the nasal fossa than in the lung at one t This slight loss in the inspiratory phase is to the action of the muscles of inspiration rounding the vestibule. The effect of this mu action serves as a "booster" and increases spiratory effort at the vestibule. The air pres has been weakened in its course from the at the expense of acquiring a "head."

CONCLUSIONS

The conclusions in this study may be divi into three parts, namely:

Nasal Fossa

1. The average reading for 220 recording an expiratory or plus reading of 1.5 mm. and inspiratory or minus reading of 5.6 mm.

2. The expiratory or plus pressure in all these dings was less than the minus pressure except 2 instances.

3. Following vasoconstriction there is always owering of inspiratory and expiratory pres-e, also a tendency for equalization of the pres-es in both nasal fossae; both the plus and the us phase level off and the pressure in the al fossa on one side approximates that in fossa on the other side.

4. Occluding a nasal fossa in any part tends raise the pressure in that fossa and some-t in the opposite fossa. Partial occlusion as h an edematous inferior turbinate tends to e the pressure in that fossa over the pressure he opposite fossa.

rillary Sinus

5. The fluctuations of pressure in the nasal a and the antrum with a single passageway often equal, but with synchronous readings will in the majority of cases detect a slight p in the antral readings, which is exaggerated h forceful respirations.

6. An accessory opening or even a large antral ning tends to equalize pressures in the antrum the nasal fossa.

7. If there is no fluctuation of atmospheric pressure, it means that either there is pus in the antrum or there is edema around the ostial passageway preventing air from going into the sinus, or both.

8. It requires more pressure within the "wash system" to flush out an antrum with an obstructed outlet. Pressures over 300 mm. are painful. Occasionally the outlet is so obstructed that saline solution cannot be forced through it. One may roughly gage the draining area by the degree of pressure required to wash the antrum: The less pressure required the more area of drainage.

Trachea

9. Contrary to accepted opinion, the variations of intratracheal atmospheric pressure are not the same as the variations of atmospheric pressure in the nasal fossa, as shown in 7 of 7 cases. I find with regard to both the plus and the minus phase that each fluctuates more in the trachea than in the nasal fossa in practically every case.

10. Frequently within the trachea the expiratory or plus pressure is greater than the inspiratory or minus pressure, whereas in the nose the minus pressure is practically always greater than the plus pressure.

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PHYSIOLOGY OF THE NOSE FROM THE STANDPOINT OF THE PLASTIC SURGEON

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Nasal physiology is a waif only recently adopted by the rhinologist. Fortunately, as often happens in such cases, the new parent seems to be making up to his new charge for the years of neglect by dressing him in new clothes and allowing him to sit at table with the family.

In dealing with the physiology of the nose as it affects the work of the plastic surgeon, I shall sketch briefly the several functions which the nose is called on to perform and afterward relate them individually to two separate fields, namely, the manipulation of the external nose and the reconstruction of the sinuses and the nasal chambers following war and industrial wounds.

The functions of the nose are several: First, it is an airway to the lower respiratory tract. Second, it is the seat of the sense of smell. Third, it protects the lung by preparing the inspired air through moistening, heating and cleansing. Fourth, it cleanses itself of the foreign material which it has removed from the air.

As an airway the nose is something more than a simple tube leading from the nostrils to the larynx. Its characteristic conformations are such that the air is conveyed over the olfactory areas and the conchae in a way best suited to the functioning of those structures.

The manner in which the air traverses the nose—the direction, the shape and the speed of the air currents—is determined entirely by a constriction occurring about 1 cm. from the external orifice. This point is comparable to the nozzle of a hose; it matters not what the size, the length or the capacity of the hose may be, the stream which it throws is characterized by the size and the shape of the nozzle. This effect, according to Zwaardemaker, was first noted by Sir Charles Bell, who contributed largely to the literature in the early decades of the last century.

The nozzle in the normal nose directs the air stream upward, where most of it passes through the olfactory fissure close to the septum and continues in a high arch to the face of the sphenoid bone and through the choana to the pharynx. Comparatively little can pass along the floo the nose and practically none of it enters meatuses. The choana, being larger than naris, has little effect on the direction of stream.

On expiration the streams of air, contrar earlier teaching, pass forward in the high a this time entering the meatuses from the l and eddying into them from the bottom. T eddies are due to the baffle effect of the n which is again acting as a nozzle, this time in other direction. Now it determines the pat of air after it leaves the nose, which is o interest physiologically but may be of some d nostic value. In passing over the turbinates inspired air becomes humidified to appr mately 90 per cent relative humidity befor reaches the larynx. In performing this func the nose gives off approximately a liter of w each twenty-four hours.

At the same time the inspired air is he almost to body temperature before reaching larynx. The heat required to be given off by nose in performing this function has been ca lated to approximate 70 large calories.

Since the average daily intake of an adult is of the order of 500 cubic feet, it will be rea seen that to maintain adequate heat and mois the whole mucosa of the nose will be require function effectively at all times.

The question is frequently asked, "Why view of the fact that the major air currents through the olfactory fissure and not through inferior meatus, is the inferior concha so m better supplied with erectile tissue than the m dle one?" This can probably be explained the fact that the erectile tissue of the infe turbinate is acting principally not as a radi but as a valve controlling the total input of nasal chamber and permitting a greater in of air during violent exercise, such as run and lifting.

Cleansing of the air takes place first by pingement against the moist surfaces of the and second by means of the electrostatic ch which is constantly being maintained on body surface. Without going into detail one say that the impingement effect occurs wh

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eam of air passing through a tube is forced change its direction or is broken into eddies some constriction or irregularity in the sur- e of the tube. In passing through the nose air is deflected from its course, starting up- rd from the nostril and finally passing down- rd through the pharynx. In the perfectly mmetric nose there are no eddies of conse- ence on inspiration, but they are produced by n minor irregularities and obstructions, such septal ridges, synechias, hyperplastic turbi- es, polyps and secretions. Since the deposit particulate matter always occurs at the distal e of the obstruction, inhaled dusts, until they carried off by the cilia, will be found dorsal the obstructions, while expired tar deposits n tobacco smoke blown through the nose, will found ventral to them.

t has been demonstrated in several ways that electrostatic charge generated on the body face by friction of clothing and surrounding ects is a factor in the removal of particulate ter from the inspired air. These charges, ch have been measured and recorded, mani- themselves in the spark which occurs on a dry day when one crosses a carpet and hes a grounded object. When the nose and dust particles bear unlike charges, adsorption s place. This principle is the foundation of e of the air-conditioning systems which ap- ed on the market just before the war.

he function of self cleansing is one which long overlooked, although it is evident that filter, to remain effective, must be freed of material which collects on it. The impor- e of this cleansing action in the nose can- be overestimated since the material collected n the air is often of a bacterial nature and quickly infect the host if allowed to grow.

n the normal nose the task of removing the mulated dust devolves on the cilia, and the ous glands assist by throwing off excess tion to wash the nasal surfaces. This is mented in some instances by the flow of tears.

complete description of the behavior of the l ciliated epithelium constitutes a story by f and I can refer here only to the more gen- aspects and those which apply to the surgi- reconstruction of the nasal chambers.

uman nasal cilia are approximately 7 microns and less than 0.3 micron in diameter. They packed closely on the free surface of the cell. beat from three to twelve times per second, nding on temperature and other circum- es, and always in the same direction. Each n has an effective and a recovery stroke. effective stroke is a sharp, stiff, quick on; the return or recovery stroke, a slower, more languid one. The cycle may be compared to the stroke of a swimmer. The cilia cover the surface like a velvet carpet and are distributed through all parts of the nose with the exception only of the preturbinal and the olfactory areas. Foreign matter entering the nose does not fall directly on the cilia but on the superimposed mucous blanket—a sheet of microscopic thickness but so tough that it is dragged off the nonciliated areas by the surrounding ciliated ones. Under normal conditions it can be seen only when picked up through a fine capillary glass tube attached to a vacuum pump. Any amount of mucus which can be removed by means of cotton pledgets, ordinary suction devices or blowing of the nose is abnormal. Ciliary beat in the sinuses is always toward and through the ostium, and that in the nose always toward the pharynx. In the sinuses and in the nose, and for that matter in the trachea and the bronchi, the ciliary pathways are definite and permanent, and threads of pus seen moving over given areas can be considered with a fair degree of certainty to have arisen from a definite ostium. The speed of these streams is of the order of 1 cm. per minute.

In order to visualize how this all works it is convenient to multiply all values by 100 and to regard the nose as a house with 10 foot rooms opening on two central corridors. All walls will be covered with velvet having a pile one fortieth of an inch high. Any dust blowing into this house will be passed along the walls, floors and ceilings, out of the door, down the hall and the back stairs to the ash can, and the complete trip will be made in twenty minutes. Such a house, having new wallpaper three times an hour, would be the cleanest house in the world! This is true of the nose. The sinuses are normally sterile; the nose, even a coal miner's is clean, and thus it remains *until something happens!*

One should examine with some care what it is that happens, for this is the concern of the plastic surgeon no less than of the rhinologist and sometimes more. The cilia, contrary to the older texts, are rugged structures. They appear early in the scale of living things and are not easily incapacitated. They continue to beat even under seemingly overwhelming conditions of infection, and massive secretions, which they have no appearance of being able to cope with, they remove with surprising speed. They work at a disadvantage under a coating of oil, but eventually even this is carried off. They are quickly regenerated following minor accidents and infections and are often regenerated even after complete removal of the mucosa. They are slowed and finally stopped by cooling, but they are not

destroyed unless the temperature drops to the freezing point. On rewarming they promptly beat with renewed and even increased vigor. Heating slows them down but destroys them only when the epithelial cell itself is injured.

Cilia have only one natural enemy—drying. Local drying is at the root of most nasal infection and should be a major consideration in the planning of any type of nasal surgical procedure.

Moisture is essential to ciliary action anywhere in nature. Since the primitive species are all aquatic, the necessary moisture is supplied by the surrounding medium. In the air-breathing species, the nasal cilia must be kept moist by means of glands. These are always present in sufficient numbers to supply the particular location in which they are found. Since the mucous blanket is microscopic, there are in certain places, such as the interiors of the sinuses, few glands—only just enough to supply it and no more. If one alters the air supply surgically, the glands may be inadequate to the demand, and local drying occurs. Drying incapacitates the cilia in a matter of minutes, and if it persists over long periods, causes metaplasia of the epithelium to the squamous type. The surgeon must guard against producing such nonciliated areas in locations where they will interfere with the cleansing of the nose and the sinuses.

He must also concern himself with the location and distribution of scars which he may produce. If these become hurdles over which the ciliary streams cannot pass, there is an accumulation of mucus which constitutes an ideal culture medium and which, therefore, remains potentially, if not constantly, a source of trouble. Patients with such conditions are frequently taking cold, and many of them have headache.

If a linear scar is troublesome, an annular scar is positively unmanageable. This is true not only in the nose but wherever it occurs. The nasofrontal duct, the external auditory canal, the esophagus and the urethra are prominent examples. When such a scar is present in an opening lined with cilia, it is objectionable not merely because it tends, by contracting, to close the opening but also because it constitutes an effective barrier to ciliary streaming.

For this reason the practice of making an entrance into a sinus by finding the ostium and enlarging it is to be condemned; an opening in any other location is preferable to it. Likewise, when any opening is made crossing a ciliary stream, the stream is balked at the scar at the edges of the opening, and as mucus accumulates it is rolled back into the sinus.

Having thus briefly outlined the principles nasal physiology, I shall discuss their applicati to the field of plastic surgery, turning first operations on the outside of the nose.

From a physiologic standpoint the most i portant external structure is the constriction nozzle 1 cm. above the external naris. Obviou this must be of sufficient size to permit free f of a volume of air adequate for respiration. L obvious but equally important is the relat size of the two openings; these should be nea alike. It is not enough that the total capac of the two sides be adequate; if a disproporti ate amount of air is forced to enter through side, that side tends to become dry and th will presently be evidence of metaplasia of t ciliated epithelium. At the same time, the re tively obstructed side is underventilated a changes likewise occur in the epithelium, wh differ from those of the overpatent side but a equally unhealthy. To this are added also t hyperemia brought about by the repeated crease in negative pressure during inspirati and the secondary results of such hyperemia.

As has been noted, these orifices should dir the air almost vertically into the nose. If one the openings is directed backward, pharyng sicca and later laryngitis sicca are almost bou to occur. If both of them are directed backwa there is impairment of the sense of smell as w and the eustachian orifices are exposed to dryi hyperplasia and eventual atrophy.

Extreme irregularities in the shape of th openings have the general effect of partial structions.

Deviations and irregularities in the bridge the nose have relatively little influence on t physiology unless they extend far enough i the fossa to produce appreciable changes in t pattern of air distribution.

The other condition which requires mention collapse of the alae which requires no elabo tion before this audience.

Compared with external surgical nasal rec structions, internal ones have been relatively frequent. However, the war is rapidly chang this situation, and many a veteran's future w depend on his surgeon's understanding of na physiology and respect for it.

Once again the size and the relative size of t two nasal fossae are primary considerations.

Shrapnel has no respect for cilia, and the s geon will have little choice in selecting the aven of approach for the removal of metallic fore bodies. However, the replacement of pa which may have been disturbed but not destroy should be accomplished with the least scarri In situations affording any choice, scars may b

made in locations least exposed to air currents, that any deficiency in epithelization may not followed by drying and consequent failure of to regenerate. This applies equally to adons which, as I have shown, produce eddies a concentration of air and dust on circumed areas.

With certain important exceptions it may be d as a general rule that a partly closed sinus a better chance than a wide open one of rning to a healthy condition. One might go ep farther and say that the latter has no ce at all. The theory that widely open ses sometimes continue to pour pus because e remote cell has not been encountered and royed is fallacious. No sinus can be perfectly thy whose ciliary epithelium is so deranged it cannot continuously keep the sinus clean. artly closed sinus may also not heal comly, but it will remain sufficiently moist to it a continuous emptying of its secretions instead of their accumulation with resulting coagulation, crusting and chronic infection.

Openings into sinuses should, whenever possible, be made in areas protected from the direct blast of inspired air. They should also be made away from the ostiums, and as far away as is feasible, in order to interfere as little as possible with their important function.

Every student has been taught that the essentials to nasal health are ventilation and drainage. To these I would add moisture, since drainage is not possible without it.

Mine is the easy task of telling what are the physiologic requirements of the nose and what it is that rhinologists must accomplish in remaking it; theirs is the far more difficult one of finding out how it is to be done and doing it.

"I can easier teach twenty what were good to be done, than be one of the twenty to follow mine own teaching."

Beaumont Building.

ROLE OF PLASTIC SURGERY IN THE FIELD OF OTOLARYNGOLOGY

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It is my sincere hope that this first scientific meeting of the American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery will mark the opening of a new epoch in otorhinologic surgery and be remembered as a milestone to its future development.

The need of incorporating plastic surgery of the head and neck into the specialty of otolaryngology is not only desirable but imperative at this time. In the early part of 1900 surgery, previously limited to the opening and drainage of abscessed cavities and the removal of pathologic tissue, took on a new complexion and became constructive rather than destructive. This can be attributed to a better understanding of clinical physiology and a reduction in operative hazards. Following World War I science assumed a materialistic attitude, and its contributions were purely physical. In this atmosphere arose a population demanding not only operations for the relief of pain and the preservation of life but elective procedures designed to make life more livable in a world moving at an accelerated tempo.

General surgery met these demands by employing plastic and reconstructive measures to rehabilitate those who were damaged by disease or injury. The otolaryngologist, unfortunately, absorbed in the more pressing problems of standardizing his operative technic in dealing with otosclerosis, infected mastoid processes, sinuses and tonsils, and interfering septums, could not spare the time to follow this general trend. Not until recently, with the discovery of the bacteriostatic properties of the sulfonamide compounds (Domagk) and the resultant reduction in the need for otolaryngologic surgery, did he have the leisure to take stock. A critical evaluation of his inventory disclosed that important parts of his domain, such as surgical treatment of structures deep in the head and neck, removal of neoplastic growths and reconstructive surgery had been usurped by other specialties.

In the past twenty-five years, owing to demands of industry and transportation and additional impetus given by the global w plastic surgery has expanded so rapidly and concepts have crowded one another so clo that the time appears ripe to reorient or s divide the specialty, if the patient is to rec maximum benefits and the teaching of the sub is to be facilitated.

There exists today no unanimity of opin with regard to the rightful place of plastic s gery as a branch of the surgical tree. controversy lies between one school of thou which believes that everything pertaining to transplantation of tissue and reconstruc should come under the domain of the gen plastic surgeon, and a second school, w advocates that plastic surgery be divided am the specialties in the various fields, based on opinion that no surgeon, however brilliant skilful, can be equally proficient in all pla procedures.

Against this second school of thought ther bound to be bitter opposition from three grou

(1) The directors of surgical departm who resent further diversion of material f their service. While it cannot be denied subdivisions carry inherent dangers, never less these may be counterbalanced by the gical director acting, in the words of Presi Conant[1] of Harvard College, as a "unify centripetal pull" against the "centrifugal fo of specialization." Experiencce shows tha well run subdivision invariably proves an a and reflects credit to the department.

(2) Plastic surgeons who feel that the cialty which they have done so much to dev to its present status is being encroached on. T it seems to me, is shortsightedness. The m trained minds focused on a single objective more rapid will be the advances in the subj The cross fertilization between the two specia cannot help but lead to a harmonious solu

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1. Conant, J. B.: The Rôle of the Endo University, Harvard Alumni Bull. **40**:71 (Oct. 1937.

heir mutual problems. The better the results more abundant will the material become. d ultimately it is bound to react to the benefit all.

3) Complacent otolaryngologists, satisfied h the existing status of their specialty. They st be aroused to the changing economic con- ons and make the necessary adaptations if the re of their specialty is to be assured. While alism is an admirable quality, they must be tical and follow significant trends. While n do not live by bread alone," nevertheless d is essential and difficult to come by, and r important things in life flourish only on its isition. The need for the otolaryngologist expand his horizon is well summarized by James A. Babbitt in his presidential address re the American Academy of Ophthalmology Otolaryngology last month (October 1943):

> . The world needed more and more finished, all d surgeons, and . . . our nose and throat sur- should rightfully cover rhinoplasty, facio-maxillary ery, neuro-otology, deep neck surgery, bronchoeso- al surgery and tracheotomy.

s a teacher of plastic surgery I have had sion to talk with many otolaryngologists, all hom are in substantial agreement that plastic reconstructive surgery of the head and neck legitimate offspring of their specialty. Cer- y their basic training and experience make the logical candidates for this type of sur- y. When one realizes the added benefits to erived by the patient from a combination of ic procedures with otolaryngologic concepts, obvious that all opposition must give way. he laity and indeed many doctors are some- under the impression that the external and internal nose are separate and distinct; in r words, that the external nose belongs to field of the plastic surgeon and the internal to that of the otolaryngologist. This idea t be strenuously combated. A brief review linical physiology quickly demonstrates that external nasal pyramid and the structures he internal nose are integral parts of a func- ing unit and that maximum functional, as as esthetic, results can be obtained only by ting them as such. Indeed, in many cases tion can be completely restored only by an ation of the external structure of the nasal mid. The president of this society brought this point in a recent paper delivered before Philadelphia Laryngological Society:

> e otolaryngologist is confronted with a recent frac- he readjusts the nasal bones as well as the septum. in an old unreduced nasal fracture he corrects the m and pays no attention to the distorted nasal bones, which may contribute as much to the disturbed function as does the septum.

While the chief concern of the otolaryngologist is restoration of function, he cannot ignore the purely esthetic element. Surely the motive that sends a patient who is not sick to him for a nasal reconstruction must be a powerful one and warrants his consideration, even in the absence of functional disturbance. Here, too, he is best equipped to benefit the patient. Since function and esthetics are intimately related, maximum results will accrue only when function is preserved.

With the increasing interest among otolaryngologists in plastic surgery, physiologic principles are being applied more and more, and the nose is no longer being treated merely as an ornament but as a functioning living structure. According to studies made by Dr. Proetz, proper air-conditioning and sinus ventilation are dependent on a normal structure of, and relationship between, the nares, the olfactory sulcus and the choanae. Obviously, these functions will be impaired by any alteration in the conformation of these structures. Thus, too thick a columella, too convex or too concave an ala or a dependent or an elevated lobule may so distort the nares as to disturb the peak positive and negative pressures. Likewise, undue convexity, concavity or deflection of the dorsum may distort the olfactory sulcus, with a consequent misdirection of the current and the creation of abnormal eddies within the nasal fossae. In this connection many septums have been sacrificed to no avail in cases in which the fault lay rather in the upper or the lower cartilaginous vault.

As physiologic concepts change, so do plastic procedures change in like measure. For instance, many rhinoplastic surgeons believe that the lower margins of the upper lateral cartilages act as valves to regulate the velocity of intranasal currents. With this in mind, it has been suggested that the cartilages be reattached to the septum following rhinoplasty. Surgeons are still at a loss, however, to know the most appropriate angle for attachment.

This is but one of the numerous problems that confront rhinoplastic surgeons daily. But with many trained minds focused on the same objective, the communion of opinion and a pooling of ideas—all worked out in the laboratory and clinic—these surgeons hope to find the answer to many questions that elude them today. Even at this early stage of the school to which the majority of the members of this society belong, many faulty concepts have already been corrected, existing methods improved, simplified and stan-

dardized, and new instruments devised. But much, of course, remains to be done.

Rhinoplastic surgery is but one of the many problems which fall into the domain of the otolaryngologist. In the surgical removal of neoplasms the patient's best interests will be conserved if the surgeon who removes the diseased tissue bears in mind the reconstruction. For example, the removal of an antral cancer can be done more radically and therefore more effectively in the consciousness that the defect can be later corrected plastically irrespective of its extent. Not infrequently it is possible to fashion the flap for the reconstruction at the time of the excision. A knowledge of plastic surgery is essential to the planning of all destructive operations about the head and neck, since a poorly planned primary operation may ruin the chances for a successful reconstruction. I speak advisedly. I have assisted for long hours in an attempt to patch up the results of such operations. Following the removal of the frontal bone in osteomyelitis, the otolaryngologist is obligated to rehabilitate the patient by reconstructing the defect. To turn him over to another surgeon is a shifting of responsibility. In otology he must be acquainted with the best plastic procedures for the correction of errors in the size, the shape and the position of the auricle, as well as with methods for partial or total reconstruction. Furthermore, in the face of the chaos of material and human destruction brought about by the exigencies of war, pl surgery of the head and neck looms into sha focus; and with the urgent need of men tra in plastic surgery, a great responsibility falls the otolaryngologist to do his part in rehabili ing those human wrecks that come within field.

In conclusion, it is my hope that member this society, imbued with the dreams, ideals principles of the school, will establish dep ments in plastic surgery in recognized postgra ate institutions throughout the country, so this surgery will be made available to a gre number of otolaryngologists and the dan incumbent on the trial and error method developing a technic thereby avoided. I visage the appearance of a galaxy of outstan names in this society which will sparkle thro the pages of history along with those of masters of the past. I look forward to the when I can echo the words of Dr. George Coates in his presidential address at the fo fourth annual meeting of the American Acad of Ophthalmology and Otolaryngology in 19 "The seed planted has sprouted, grown, borne fruit in the crops of postgraduate gr in all sections of the country."

Finally, I deem it a great honor to re paper before this society, especially when I sider the attainments of its members.

307 Second Avenue.

REPORT OF ISOGRAFT TRANSPLANTS IN IDENTICAL TWINS

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NEW YORK

Transplants are classified as (1) autogenous transplants—tissue completely separated from its original site and implanted in another location in the same individual—and (2) heterogenous transplants—tissue taken from other individuals. The second class may be subdivided into (*a*) homogenous grafts (known as isografts)—tissue from the body of an individual of the same species—and (*b*) zoografts—tissue from animals of different species.

The experiences of the past may be summarized as follows:

Heterogenous transplants with the exception of those composed of avascular tissue, such as epidermis, cartilage and cornea, and those between twins developed from the same ovum, have lost their position in scientific medicine. All attempts to employ them have met with failure despite every measure taken to insure success—such as conformity of blood groups, consanguinity, identity of race, and so on.

McWilliams asserted: "The result will most certainly be nil, the success of isografts may be relegated to mythology." The successful reports are undoubtedly based on faulty observations.

Loeb suggested that the biochemical differences in the proteins of different persons create an antagonism between the protein of the host and that of the graft and explained the phenomenon on the assumption that the tissue of every person contains certain chemical characteristics peculiar to the tissue, which he calls the "Individuality Differential." The differentials determine the reaction between donor and host. Immunization of the host or the donor by injection of serum, tissue extracts or chemicals have proved worthless.

Lexer concluded: "Homografting promises nothing and the trouble and suffering of the donor is without avail." In apparently successful cases it has been shown at biopsy that there was a complete refusal of the recipient's blood vessels to enter the donor skin. All these grafts die or are replaced by the host's tissue masking the disappearance of the graft.

Identical or monozygotic twins are derived from a single fertilized ovum which splits into two halves at a very early stage of embryonic development, each half carrying precisely the same complement of genes. They are always of the same sex and are genetically as identical as the right and left halves of one individual.

The only method used at present for classifying twin partners in respect to their zygotic origin is the modern similarity method, since it is known now that not all of the monozygotic twin pairs are necessarily monochordial. If twinning occurs at a very early stage of development, two separate chorions may be developed even in monozygotic twins, although it is the rule only for dizygotic twins.

The method is based on the fact that if the chances of two siblings or fraternal twin partners being alike in a variation of one such trait is 1 to 2, the chances of their being alike in ten such traits is 1 in over 1,000. Among the traits used are color of hair and eyes, form and texture of hair, blood group, facial features, arrangement of teeth, color and texture of skin, proportions of hands and fingers and the microscopic characteristics of finger and palm patterns. One twin must be right-handed and the other left-handed, although this may be masked by training. The finger prints resemble those of the opposite hand (mirror symmetry), and situs inversus may be present.

The twins whom I mention here were certified as identical by Dr. Franz Kallmann, of the New York Psychiatric Institute.

The twins, Elizabeth D. and Veronica D., donated their time and small areas of their skin for transplantation for scientific purposes and gave permission to use any photograph in our possession.

Read at the First Annual Meeting of the American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, New York, Nov. 12, 1943.

EXPERIMENT

Anesthesia.—A field block was made with 1 per cent procaine hydrochloride.

Operation.—On Aug. 4, 1943. Two full thickness skin grafts measured off with sterilized twenty-five cent pieces were removed from Elizabeth's left arm and exchanged with full thickness grafts from identical situations on Veronica's right arm (mirror symmetric transplantation) and left arm (crossed transplantation). The grafts were sutured into place with atraumatic sutur and pressure dressings applied. A primary take w registered in each graft.

The pictures (figure) show the procedu more adequately than words can describe.

Isografts in identical twins: *E* is Elizabeth; *V*, Veronica. *A* represents crossed transplantation (from le arm to left arm); *B*, mirror symmetric transplantation (from left arm to right arm). The grafts were made Aug. 4, 1943. The pictures were taken on Oct. 4, 1943.

This work was carried out in cooperati with the Fomon Group.

115 East Sixty-First Street.

INJECTION OF THE TYMPANUM FOR CHRONIC CONDUCTIVE DEAFNESS AND ASSOCIATED TINNITUS AURIUM

A PRELIMINARY REPORT ON THE USE OF ETHYLMORPHINE HYDROCHLORIDE

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Injection of the tympanum as a method of treatment in deafness was first suggested and used by Gray[1] in 1934 at the Middlesex Hospital in London. Gray advocated this type of therapy for otosclerosis. He employed thyroxin as the medium of injection. However, his choice of thyroxin was made on an empiric basis. Although there is some evidence to indicate that hereditary endocrine dysfunction of the thyroid giand is present with otosclerosis, thyroxin was not selected primarily for this reason. Gray's first purpose was to find an agent which when applied locally would produce active congestion of the blood vessels in the tympanum and at the same time be free from any qualities which might cause an inflammatory reaction. The basis of thyroxin therapy, as explained by Gray in his views on the cause of otosclerosis, was to stimulate circulation in the organ of hearing through active congestion of the minute blood vessels in the tympanum.

Subsequently, Goldstein,[2] of St. Louis, employing Gray's therapy, reported on a series of cases in February 1936 and again in July 1938. However, the results with thyroxin therapy have not been altogether encouraging. This, in addition to the fact that the therapy is quite empiric and the fact that the explanation for the improvement is somewhat vague, has reduced interest in this method of treatment.

With Gray's work in mind, I wish to suggest a new application of the method of treatment which he introduced. Otologists have long realized the limitations of the indirect methods employed in the treatment of chronic conductive deafness. For lack of better therapy, politzerization, catheterization and otoscopic tympanic massage have constituted the chief means of treating chronic conductive deficiencies of hearing. The need for a direct method is readily realized.

In selecting a drug to be injected into the tympanum, I sought one which would incite a sterile inflammation with subsequent absorption of the scar tissue, cicatricial bands and adhesions that interfere with the normal functioning of the conductive mechanism.

The therapeutic value of ethylmorphine hydrochloride in removing pupillary exudates and in absorbing interstitial corneal deposits has long been known in ophthalmology. It acts as a vasodilator and lymphagogue, stimulating the vascular and lymphatic circulation of the eye, producing marked dilatation of these vessels. It is for these physiologic effects that ethylmorphine hydrochloride was selected for injection into the tympanum. In addition, the drug produces analgesia, which counteracts the discomfort of the injection and of the subsequent inflammation. This factor is of great importance, as the patient is not incapacitated and is able to continue at his daily occupation without discomfort.

In reviewing the literature on the various methods of local treatment of the tympanum for improvement of hearing, it was found that Randall[3] had used ethylmorphine hydrochloride essentially for the same reason but by a different method. He attempted to introduce a solution of the drug through a eustachian catheter by means of a Politzer bag. However, the numerous difficulties involved in successfully introducing the solution into the tympanum made this method impracticable.

Hearing deficiencies particularly benefited by the intratympanic injection of ethylmorphine hydrochloride are those which arise in cases of chronic nonsuppurative inflammation of the middle ear. In this category can be included cases of chronic catarrhal otitis media and cases in which previous suppuration of the middle ear has occurred with "drying up" of the ear. The improvement in acuity of hearing following a

From the Department of Otolaryngology of the Alfred Benjamin Dispensary.

1. Gray, A. A.: Otosclerosis Problem, Proc. Roy. Soc. Med. **27**:1179-1205 (July) 1934.

2. Goldstein, M. A.: Thyroxine in the Treatment of Otosclerosis: Preliminary Report, Laryngoscope **46**: 112-119 (Feb.) 1936; Thyroxine Therapy in Otosclerosis: Report of Forty-Two Cases, ibid. **48**:443-458 (July) 1938.

3. Randall, cited by Gleason, E. B.: Manual of Diseases of the Nose, Throat and Ear, ed. 4, Philadelphia, W. B. Saunders Company, 1918, p. 569.

series of injections of ethylmorphine hydrochloride is due in all probability to the stimulation of circulation in the middle ear and the subsequent absorption of scar tissue, cicatricial bands and adhesions which interfere with the functioning of the conductive mechanism. In chronic catarrhal otitis media the ossicles frequently become ankylosed; adhesions form which bind them to one another or to the surrounding bony walls of the tympanum, while bands of connective tissue may extend across the tympanum or the mastoid antrum. It is for the purpose of reestablishing a flexible ossicular chain that this therapy is recommended. The absorption of cicatricial bands and adhesions in a "dry" ear following healed suppurative otitis media produces improvement in hearing in these cases. Likewise, tinnitus of a vibratory character arising from interference in the functioning of the middle ear mechanism is often arrested by this therapy.

Fig. 1.—Material for injection therapy.

SELECTION OF CASES

If good results are to be obtained, the cases for injection must be properly selected. The following points are essential:

1. The deafness must be of the chronic conductive type that has been described. Patients with pronounced degeneration of the acoustic nerve are not benefited by this type of therapy.

2. There must not be a profound loss of practical hearing. If deafness is marked, even a considerable improvement in hearing may not approach a practical hearing level.

3. Air conduction tests made with the audiometer should show a loss of hearing for low tones not to exceed an average of 30 decibels at the 256, 512, 1024 and 2048 frequencies.

4. The vestibular mechanism must be normal as tested by the caloric method.

5. There must be absence of any acute auricular infection.

6. The tympanic membrane must be intact. Cases in which previous suppuration of the middle ear has occurred with "drying up" of the ear are amenable to this therapy.

7. The external auditory canal must be normal without cellulitis, furunculosis, eczema or other disorder.

8. There is no definite age limit, but it must be remembered that ethylmorphine hydrochloride is a derivative of opium and that systemic effects resembling those arising from morphine conceivably could be produced by injecting too large amounts of a high concentration of the solution, especially in children.

TECHNIC

The technic of injection is essentially the same as that described by Gray and Goldstein for the use of thyroxin. An aniline oil-cocaine solution (chemically pure aniline oil 90 parts, cocaine hydrochlorate 10 parts) is used to produce local anesthesia by applying a wick saturated in the solution against the tympanic membrane. Aniline oil may produce symptoms of aniline poisoning; hence the external canal should be wiped clean following the removal of the

. However, no ill effects from the local use e solution have been observed in this work. patient is placed in a regulation treatment r in a semirecumbent position. With a tuber- syringe and a no. 26 M. P. 1½ inch cm.) needle (fig. 1) 4 minims (0.25 cc.) 1.5 per cent solution of ethylmorphine rochloride is injected into the tympanum ugh the posterior inferior quadrant of the panic membrane. Immediately after the in- ion the patient inclines the head posteriorly at degree angle and opens the mouth widely. r several minutes he may close his mouth must continue to keep the head back for roximately ten minutes. Occasionally tran- membrane can be observed within six hours after the injection. All inflammatory signs subside within four days after the injection. The treatment consists of successive instillations of a 1.5, 2.5, 3.0 and 3.5 per cent solution of the drug at four to seven day intervals. No definite rule governing frequency of injection can be laid down since patients differ in their response to the injections. Supplementary politzerization, catheterization and otoscopic tympanic massage several days after each injection facilitate the breaking down of adhesions in the tympanum.

Prior to the institution of the therapy an audiometric analysis of the hearing deficiency should be made. As pointed out previously, a careful audiometric examination is essential to determine the type and the amount of the hearing defect.[4] Follow-up audiograms on the hearing of these patients have shown the maximum

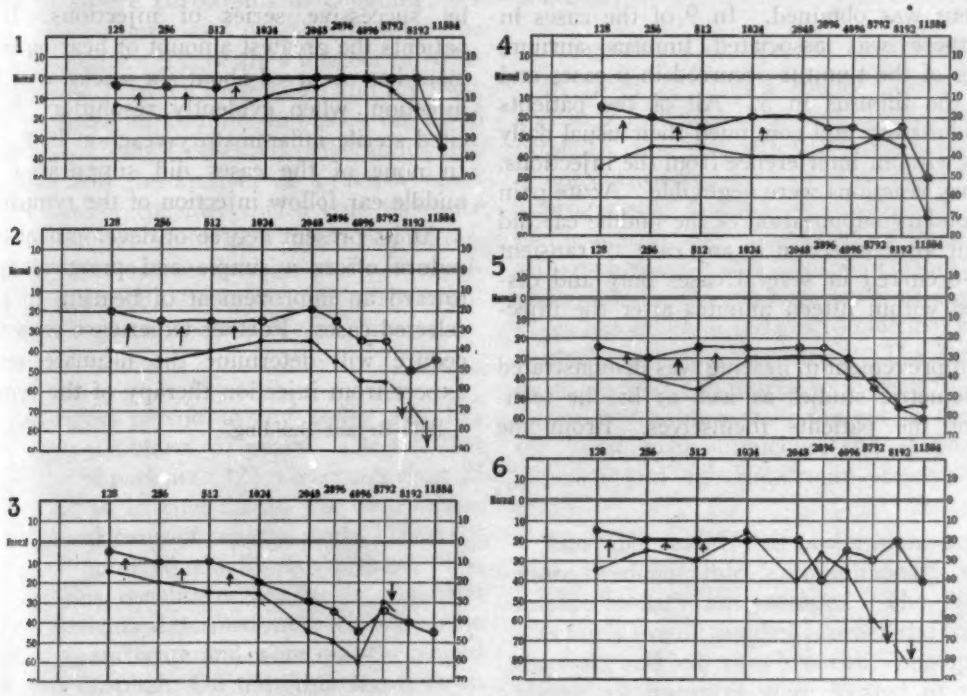

Fig. 2.—Audiometric studies following injection therapy:

Right ear of H. W. O., 42 years old. The lower curve was taken on Dec. 28, 1941 and the upper one eb. 26, 1942; at the later date tinnitus was gone.

Left ear of F. W., 34 years old. The lower curve was taken on Jan. 15 and the upper curve on March 42.

Right ear of I. W. E., 44 years old. The lower curve was taken on Feb. 18 and the upper curve on 7, 1941.

Left ear of W. L. B., 38 years old. The lower curve was taken on April 19 and the upper curve on 7, 1942.

Right ear of E. R., 23 years old. The lower curve was taken on Oct. 18 and the upper curve on 8, 1941.

Left ear of K. W. G., 44 years old. The lower curve was taken on Feb. 25 and the upper curve on 14, 1941.

vertigo follows the injection. Surprisingly reactions have occurred following the injec- After the instillation of the solution, rela- analgesia occurs, lasting four hours or r. Patients rarely complain of any painful tion but rather of a feeling of fulness in ar. Inflammatory changes in the tympanic

4. Trowbridge, B. C.: Electroaudiography: The Analysis and Interpretation of the Audiogram, Arch. Otolaryng. **35**:899-914 (June) 1942.

improvement to occur one to two months after a series of injections. Improvement in hearing governs the number of subsequent series of injections.

RESULTS OBSERVED

Audiograms of several patients taken before and after treatment by injection of ethylmorphine hydrochloride are shown in figure 2.

The error of drawing definite conclusions from a small series of cases is realized. However, the trend of the effectiveness of a therapeutic procedure is best demonstrated by the application of the statistical method. In a series of 22 cases selected for this type of therapy, improvement in hearing occurred in 18 cases. In 4 cases no improvement was obtained. In 9 of the cases in which there was associated tinnitus aurium, lessening of the tinnitus occurred in 6 cases and loss of the tinnitus in 3. All of the patients were ambulatory and continued their usual daily routines without interference from the injections. Secondary reactions were negligible. Acute pain and secondary suppuration of the middle ear did not occur after injection in any case. Transient vertigo occurred in several cases only and disappeared within fifteen minutes after the injection.

The improvement in hearing was demonstrated by audiometric studies as well as by the testimony of the patients themselves. From the clinical point of view the audiometric measurement is the test of the efficacy of the proce but for practical purposes the success of therapy is measured by the patient himself, appreciates a subjective improvement in he and freedom from tinnitus.

SUMMARY AND CONCLUSION

Analysis of the results of the injection the described indicates that definite improve in hearing and diminution or loss of tin occur in the cases for which it is recommen At this stage the observations with the cedure do not permit a definite statement a the extent to which the hearing can be impr by successive series of injections. In patients the greatest amount of hearing impr ment has occurred about six weeks after the injection, when evidently resolution of the cited sterile inflammatory reaction has occu In none of the cases did suppuration of middle ear follow injection of the tympanum

At its present degree of development the cedure offers a simple and practical appr toward an improvement of hearing in prop selected cases. Further experience with the cedure will determine the ultimate result expect from injection therapy of the tympa

1808 Bryant Building.

PERFORATION OF TUBERCULOUS LYMPH NODES INTO THE TRACHEA AND BRONCHI

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NEW YORK

Since its first description, by Leblond [1] in 1824, ture of caseous lymph nodes into air passages received much attention in the literature mmaries by Barthez and Rilliet,[2] Ebert [3] and bie [4]). Most of the reports deal with chil- in apparent good health who are suddenly ed with severe paroxysms of coughing, be- e deeply cyanotic and die shortly after the et of the attack. There are a number of strik- differences between these cases and my own. In the course of routine autopsies on 1,656 erculous persons I observed perforations into trachea and the bronchi 22 (1.3 per cent) es. I cannot consider this a true incidence ause I do not know how often a progres- cavity develops at the site of an intrapul- ary perforation, the subsequent disease ob- rating all signs of the rupture.

AGE

The youngest person in my series was 1½ rs of age; the oldest, 57 years. The fact that majority of patients (12) were more than 21 rs of age is in contrast to the distribution en in the majority of reports, namely, that the forations occurred chiefly in children. The son for this conclusion lies in the fact that ost all patients described were children who begun to suffocate and were quickly rushed a general hospital. On the other hand, in an titution for tuberculous patients where adults dominate, the perforation develops usually in course of progressive tuberculosis.

RACE

From the table it may be seen that 16 patients re Negroes. This fact is in contrast to the racial distribution in my complete autopsy series, in which the proportion of Negroes to white persons is 4:7. In a previous study [5] I pointed out that perforation of tuberculous "cold abscesses" into the neighboring structures likewise occurs far more frequently in Negroes than in white persons.

NUMBER AND SITE OF PERFORATIONS

In 13 of 22 cases a single rupture occurred, and in 9 instances 2 or more perforations were present. The presence of multiple perforations is not surprising, since in most cases there was a progressive caseous tuberculosis of the lymphatic system with a tendency to liquefaction of all lymph nodes. The multiple perforations took place not only in multiple areas of the air passages but also into the gastrointestinal tract, particularly into the esophagus. The largest and most numerous ruptures were seen in 1 case in which perforations were present in the trachea, the right main bronchus, the esophagus, the stomach and the duodenum—twelve openings in all.

The table reveals that perforations occur much more frequent into extrapulmonary than into intrapulmonary air passages. The distribution was fairly evenly divided between the trachea and the right and left main bronchi. The openings in almost all instances were located in the lower part of the trachea or in the upper part of the main bronchi. Thus the perforations occurred mainly in the region of the carina. Our findings do not bear out the conception of Paunz,[6] that the rupture occurs mainly on the right side, or that of Engel,[7] that the trachea is the chief site.

PATHOLOGIC APPEARANCE

The size of the openings varied from 4 mm. to 5.5 cm. The borders of the perforations in

From the Department of Pathology, Sea View spital.

1. Leblond: Sur une espèce de phthise particulière enfants, Inaug. Dissert., 1824; cited by Barthez Ribbert.[2]
2. Barthez, E., and Rilliet, F.: Handbuch der Kinankheiten, Leipzig, 1856, vol. 3, p. 727.
3. Ebert, O.: Ueber den Durchbruch käsiger nchialdrüsen in benachbarte organe, Mitt. a. d. mb. Staatskrankenanst. **7**:213, 1908.
4. Scobie, R. B.: Acute Asphyxia from Intrabronl Rupture of a Tuberculous Mediastinal Gland with overy, Am. J. Dis. Child. **48**:373 (Aug.) 1934.
5. Auerbach, O.: Rupture of Cold Abscesses into the Lungs and Pleurae, Clinics **1**:600 (Oct.) 1942.
6. Paunz, M.: Das klinische Bild des Durchbruches tuberkulöser Tracheobronchialdrüsen in die Luftwege bei Kindern, Acta oto-laryn. **21**:279, 1934.
7. Engel, E.: Die Klinik des Primärkomplexes, in Engel, S., and Pirquet, C.: Handbuch der Kindertuberkulose, Leipzig, G. Thieme, 1930, p. 314.

the early ruptures were irregular, granular and often yellow. In the older ruptures the borders were regular and smooth.

The lumen of the perforation may be completely occupied by the caseous mass of the underlying lymph node. This mass may also protrude for a variable distance into the lumen of the air passage, causing a decrease in its diameter. The caseous plug may represent either a portion of the lymph node which has not yet undergone liquefaction or a sequestrated portion of caseation too large to pass through the hiatus into the air passage.

In other instances the perforation opens into a cul-de-sac, the lumen of which is almost completely empty or is filled with a soft yellow caseous material, the state of the lumen depending on how long after rupture death ensued. If death occurred soon after perforation, the cul-de-sac is filled. If, as in older ruptures, a longer period elapsed before death, the liquefied lymph node emptied variable quantities of its contents into the air passages. The inner wall of the sac is lined by a yellow granular membrane. The lymph nodes, which are almost completely liquefied, are usually small and form a nodular protrusion on the inner wall of the air passage.

The lymph nodes are intimately adherent to the outer wall of the air passages. In these cases in which the caseous contents are completely liquefied the outer wall of the air passage in this region is formed by the outer wall of the gland. It is this intimate adhesion, almost always present, which prevents leakage of caseous contents into the mediastinum and development of mediastinitis.

In 7 cases a calcified lymph node perforated the lumen of the air passages. Although the rupture of calcified nodes is seen more frequ in adults, it occurs also in children. Two of 7 patients were children (aged 1½ and 2 y respectively). In 1 instance a calcified bronchial lymph node ruptured into the lower lobe bronchus and at autopsy the calc mass completely occluded the lumen of bronchus. In another case, the fact that a c fied peritracheal lymph node perforated anteri into the trachea and posteriorly into the es agus resulted in a tracheoesophageal fistula. is the only case in my series in which the perf tion also communicated with the mediasti and resulted in mediastinitis.

The development of emphysema in the m astinum, extending into the neck, from the r ture of a tuberculous lymph node into the

Summary of Cases

Case No.	Age	Race	Sex	Site of Perforation in Air Passages															Other Glandul Perforations
				Trachea	R. M. B.	L. M. B.	R. U. L.	L. U. L.	R. L. L.	L. L. L.	R. M. L.								
1	31	N	M	..	+	..	..	..	..	..	..								Esophagus: jejun ileum; colon
2	22	W	F	..	..	+	..	..	..	..	..								
3	16	N	M	+	..	..	..	+	..	..	..								
4	15	N	F	..	..	..	+	..	..	..	..								
5	53	N	M	+	..	..	..	..	..	..	..								Esophagus
6	16	N	M	+	+	+	..	..	..	..	..								
7	31	N	M	+	..	..	..	..	..	..	+								
8	7	N	F	..	..	+	..	+	..	..	..								
9	28	N	M	..	+	..	..	..	..	..	..								
10	57	N	M	..	..	..	..	..	+	..	..								
11	22	N	F	..	..	+	..	..	..	..	..								
12	1½	N	M	..	..	..	+	..	..	..	..								
13	2	N	M	..	+	..	..	..	+	..	..								
14	24	W	M	..	+	..	..	..	..	..	..								
15	33	W	M	..	..	+	..	..	..	..	..								
16	28	N	M	..	..	..	..	..	..	+	..								
17	11	N	F	+	+	+	..	..	..	..	..								Esophagus
18	28	Y	M	..	..	..	..	..	+	..	..								Ileum
19	33	W	M	..	..	..	..	..	+	..	..								
20	26	W	F	+	+	..	..	..	..	..	..								Esophagus; stom duodenum
21	2	N	M	..	..	..	..	..	+	..	..								
22	16	N	M	..	..	..	+	..	..	..	..								

passage was first described by Benda,[8] thought that this circumstance might be an in establishing the diagnosis of perforation. Si lar observations were made by Orel[9] and Paunz.[10]

Microscopically the inner wall of the perf tion, as well as the inner wall of the lique lymph node, like that of any other tubercul cavity or ulcer, is lined by a zone of caseatio by a pyogenic membrane. Beyond this is an a of tuberculous vascular granulation tissue c

8. Benda, A.: Durchbruch tuberculöser Bronch drüsen in die Luftwege, Pester med.-chir. Presse 102 (Feb. 2) 1902.

9. Orel, H.: Zwei Fälle von Durchbruch tube löser Lymphdrüsen in den Bronchus bzw. in Trachea, Jahrb. f. Kinderh. **139**:379 (June) 1933.

10. Paunz, M.: Beitrag zur Diagnose des Du bruchs tuberkulöser Tracheobronchialdrüsen in die L wege, Ztschr. f. Hals-, Nasen- u. Ohrenh. **32** (March) 1933.

sed of dilated capillaries, fibroblasts and epithe-
d and giant cells.

Liquefaction of the caseous lymph node may
cur in one of two ways. In one form a demar-
tion zone of polymorphonuclear leukocytes is
esent between the area of caseation and the
rrounding healthy lymph node tissue. In the

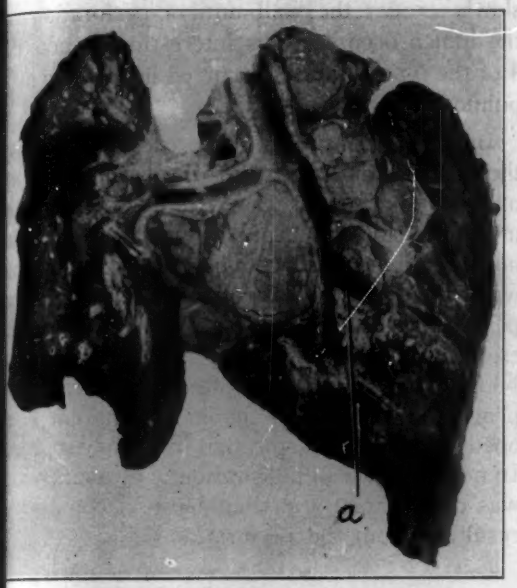


Fig. 1 (case 21).—Coronal section of the lungs, show-
g a perforation of a caseous peribronchial lymph node
the right lower lobe bronchus (*a*).

ond form the leukocytes encircle and invade
e area of caseation. The first type of liquefac-
n has been designated as the sequestrating
d the second as the abscess form.

In the abscess form the caseous material is
mpletely liquefied and the contents of the lymph
de, after perforation of the air passage, either
e expectorated or are aspirated into the paren-
yma of the lung. In the other type, large por-
ns of the caseous lymph node itself are seques-
ted. In some instances the size of the per-
ation is smaller than that of the sequestrum,
d the caseous mass, although it may partially
end into the lumen of the air passage, cannot
mpletely pass through the perforation. If,
wever, the size of the sequestrum is such that
can be delivered through the perforation, it
y be, on the one hand, expectorated or, on the
er, aspirated into the bronchi. If the seques-
m is large enough, it may even result in the
focation of the patient.

PATHOGENESIS

In all but 6 of my cases the perforation of the
ph nodes into the air passages occurred in
sons who had a progressive caseous tubercu-
is of the lymph glands of the thorax. Either
the involvement of lymph nodes is part of a primary complex, in which case the perforations are usually observed in children, or it is part of a lymphohematogenous tuberculosis and is usually present in adults. In the latter instance there is an extensive caseous tuberculosis of the lymphatic system, often involving the cervical, thoracic and abdominal chains.

Progressive caseation of the lymph nodes results not only in enlargement of the individual glands but in adhesion of the glands to neighboring structures. A perifocal inflammatory reaction within the node results in a fibrous thickening of the capsule and adhesion of the adjacent glands. In addition, there is an adhesion of the capsule of the glands to the adventitia of the neighboring air passages. Generally, in spite of progressive caseation, the thickening of the capsule of the gland keeps pace with the increased necrosis. This accounts for the relatively small percentage of perforations. In a relatively few cases the caseous process within the gland occurs more rapidly than the fibrosis of the capsule, and

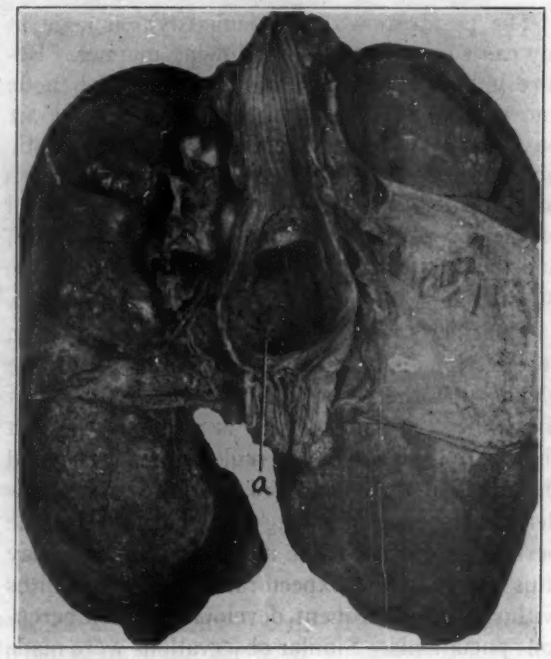


Fig. 2 (case 17).—Posterior view of the lungs and the esophagus. There is a large tracheoesophageal fistula secondary to the liquefaction of the caseous lymph nodes (*a*).

the necrotic process progressively involves the capsule and the wall of the air passage to which it is adherent. In those cases in which the caseation has not yet involved the mucosa of the trachea or bronchi, yellow areas are seen shining through the mucous membrane of these structures.

What factors are necessary for the liquefaction and perforation of the caseous nodes I cannot say. It is rather interesting to note that I have never observed tuberculous mediastinitis resulting from perforation of a liquefied caseous gland through its capsule into the mediastinal space; nor, similarly, have I ever observed a tuberculous peritonitis resulting from perforation of a mesenteric node. These circumstances may be accounted for by the fact that the perifocal reaction keeps pace with the progressive caseation in the gland. When, however, the gland adheres to the surrounding structures there is no room for a perifocal reaction to develop, and when there is a progressive caseation the necrosis continues until it reaches the lumen of the air passages.

Although I have occasionally seen liquefaction of a caseous lymph node when there has been no erosion of a neighboring structure, most of the instances of liquefaction were observed after the caseous process had extended into the lumen of the adjoining structure. Apparently the contact of the caseation with an open space is a factor in the production of liquefaction.

The perforation of a calcified lymph node in my cases occurred in the following manner. Before it became calcified the caseous lymph node had partly extended through the wall of the air passage and in its extension destroyed the elastic fibers. After calcification occurred, the sharp particles of the gland, now embedded in the wall of the air passage, gradually eroded the latter, and the calcified portions were extruded into the lumen.

The microscopic examination did not reveal a reactivation of the tuberculous process in the gland but rather showed a mechanical erosion of the wall. Evidence of this is found in the fact that there is no active tuberculosis present beyond the calcified focus, and only rarely is there evidence of spread following the evacuation of the perforated glands. The mechanical erosion may thus result in the expectoration of broncholiths without the subsequent development of tuberculous pneumonia. Similar observations were made by Beitzke,[11] Fleischner,[12] Vinson and Pembleton.[13] Arnstein,[14] on the other hand, found that the perforation frequently was the result of an endogenous lymphoglandular exacerbation and that the rupture usually led to tuberculous aspiration foci in the component lung parts.

In the course of respiration there are contraction and expansion of the air passages. As the wall expands, the calcified area is compressed and slowly erodes the wall until a perforation into the lumen occurs. It is interesting to note that 4 of the 6 perforations occurred in calcified intrapulmonary lymph nodes.

In all but 1 instance the spread resulting from the perforation consisted of tuberculous pneumonia. In 1 other case examination revealed numerous small areas of pulmonary gangrene and nontuberculous bronchopneumonia. This case was that previously mentioned in which a small peritracheal calcified lymph node between the esophagus and the trachea had perforated into both structures and resulted in a tracheoesophageal fistula. The pulmonary gangrene developed as a result of aspiration from the esophagus. In no other case of perforation of a calcified focus was death directly attributable to a complication resulting from the perforation.

CLINICAL OBSERVATIONS

In 1 case a diagnosis of the perforation was made clinically. In none of my cases was there a dramatic, rapid course ending in death due to suffocation. The clinical findings are in contrast to those in the vast majority of reports in the literature in which through the aspiration of lymphoglandular sequestrums attacks of asphyxia suddenly developed and the patient was brought to a general hospital, often with the mistaken diagnosis of an aspirated foreign body. The reason for this discrepancy lies in the fact that in my cases the process was either that of large caseous masses which had not emptied into the tracheobronchial tree or that of an abscess formed by liquefaction in which the fluid contents of the lymph node were poured through the opening into the air passages. Paunz [10] correctly points out that when fluid parts rupture through the air passages no correct clinical diagnosis can be made of the conditions, the correct diagnosis being first established at autopsy. In all the cases in my series the persons affected were admitted to a hospital for tuberculous patients with progressive tuberculosis in some organ system.

Fifteen of the 22 cases showed a progressive caseous process of the lymphatic system. Roe-

11. Beitzke, H.: Pathologische Anatomie des Primärkomplexes, in Engel, S., and Pirquet, C.: Handbuch der Kindertuberkulose, Leipzig, G. Thieme, 1930, p. 159.

12. Fleischner, F.: Atelektase und atelktatische Pneumonie bei Ausstossung oder Durchbruch eines tuberkulösen Drüsenherdes in den Bronchus, Beitr. z. Klin. d. Tuberk. **86**:72 (Feb.) 1935.

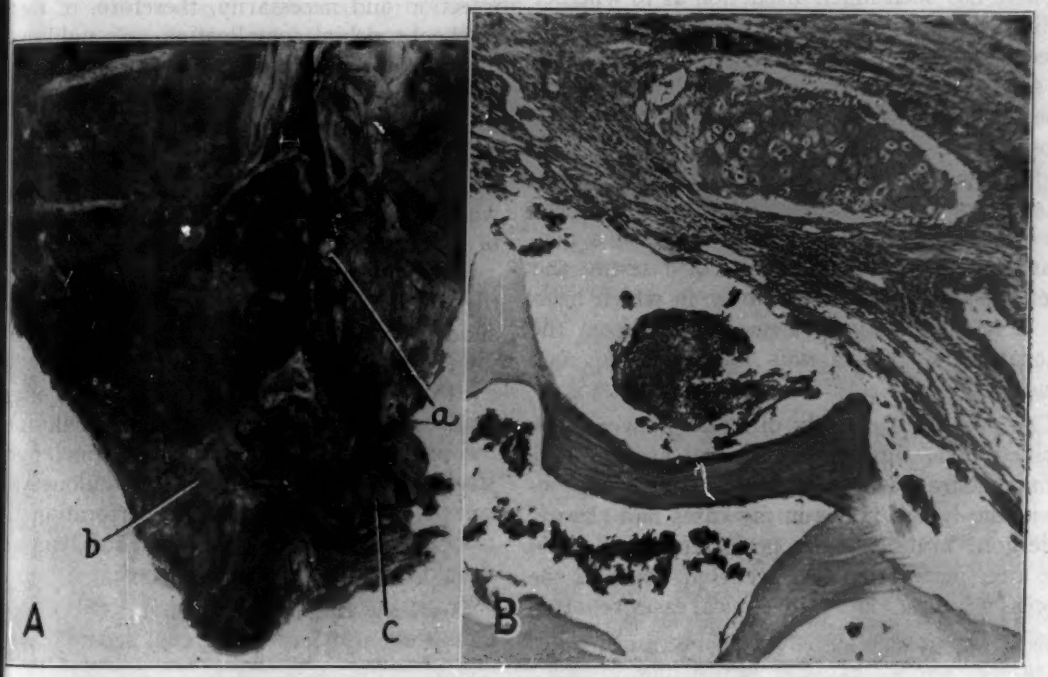
13. Vinson, P. P., and Pembleton, W. E.: Ulceration of Tuberculous Hilar Lymph Node into Lumen of Bronchus, with Bronchoscopic Removal, Ann. Otol., Rhin. & Laryng. **49**:797 (Sept.) 1940.

14. Arnstein, A.: Indurative und Zerfallsvorgänge den mediastinalen Lymphknoten im höheren Alter Schädigung der benachbarten Organe, Beitr. z. k. d. Tuberk. **85**:197 (Aug.); 343 (Oct.) 1934.

grams of the chests of most of these persons aled a widening of the mediastinum due to nlargement of the tracheobronchial lymph s. In only 2 of the 15 cases was there a y present in the lungs before the rupture of ymph node. In the other 13 the lungs either clear or showed only small seedings before perforation, the process being extensive tulosis limited chiefly to the lymphatic system. here were two events which often followed perforation. One of these was the sudden arance of tubercle bacilli in the sputum or ic contents; the other was a bronchogenic emination from the aspiration of the caseous ents into the pulmonary parenchyma.

or peribronchial lymph node emptied its contents into the adjoining air passage. Although slight spread was observed with perforations of extrapulmonary as well as of intrapulmonary lymph nodes, in cases of the latter the dissemination was usually confined to the lobe supplied by the perforated bronchus, whereas in the former the seedings were found in all lobes.

Another possible sequela of perforation of a lymph node into the air passage is occlusion of the lumen of the bronchus by a sequestrum of the gland. This was observed clinically by Fleischner,[12] when tuberculous lymph glands ruptured into a branch of an intrapulmonary bronchus. In the 3 cases described by him, the roentgenogram



ig. 3.—*A* (case 19), coronal section of a portion of the lower lobe of the right lung, showing a calcified ronchial lymph node within the lumen of the bronchus (*a*). The lung parenchyma below the perforation s fibrosis (*b*) and bronchiectasis (*c*). *B* (case 19), photomicrograph of the lymph node seen in *A*, showing occlude the entire lumen of the bronchus. The node is almost completely ossified. There is no active rculous process present.

e appearance of tubercle bacilli in the sputum not always followed by an extensive spread the lung tissue. In some instances there was and in others no spread following the first rrence of a positive sputum. These patients aled a recent rupture into the air passage, usually the liquefying process was that of the strating form in which most of the caseous cles had not yet been evacuated.

tensive spread was usually observed in the s in which there was an abscess form of liquen in a large gland, the caseous contents boured into the air passages. Slight spread been in the cases in which a small peritracheal

revealed an atelectasis of the pulmonary parenchyma beyond the occluded bronchus. In all 3 of his cases the lymph nodes were expectorated after a severe coughing spell and the atelectatic portion of the lung soon became reaerated.

A similar case was described by Vinson and Pembleton.[13] In their case an infiltration was present over the base of the lower lobe of the right lung, with complete absence of breath sounds over this area. After a bronchoscopy in which a forceps was applied to a mass in the right lower lobe bronchus, a large caseous calcified portion of a lymph node was expectorated. Three months after this a roentgenogram re-

vealed an almost complete disappearance of the previously visualized infiltration of the lung.

In 1 of my cases a tuberculous lymph node which showed ossification had perforated a branch of the right lower lobe bronchus, had completely occluded its lumen and had become embedded in its wall. The portion of the lung aerated by this branch bronchus was completely fibrotic with areas of bronchiectasis. Thus the perforated gland acted as a foreign body, producing a bronchopneumonia beyond it, which became organized and resulted in a pulmonary fibrosis with cylindric bronchiectasis.

HEALING

There has been much discussion as to whether healing occurs after the perforation. My findings agree with those of Beitzke,[11] who doubted that the softened caseous material might be completely expectorated, with subsequent complete healing. Those persons who showed a perforation of softened caseous nodes into the air passages in my series revealed a progressive caseation of the entire lymphatic system. The presence of a perforation is merely an indication of a severe and extensive lymphatic tuberculosis, in which healing is hardly likely to ensue merely from the evacuation of the caseous material from one gland.

The process is entirely different in which the calcified node through mechanical erosion perforates the tracheobronchial tree. Since the process in the lymph nodes in my cases had already undergone healing before perforation, one could not, after perforation had occurred, consider the process a healing one. The clinical cases reported in the literature in which healing followed pectoration or bronchoscopic removal of the forated mass are usually instances of caseous cified lymph nodes.

SUMMARY AND CONCLUSIONS

A study has been made of 22 cases in w tuberculous lymph nodes caused perforatio one or more points in the tracheobronchial and of the sequelae of this complication. A sion of the lymph node to adjacent structure an important bar to the development of t culous mediastinitis in such cases.

The systemic disease in the cases studied usually found to be a fulminating lymphohem genous tuberculosis in which cure of the ge infection and necessarily, therefore, of the l tracheobronchial complication was unlikely. infrequent but important exception occurre the cases in which a calcified particle, in i the end stage of a healing process, was source of the perforation. In these cases normal respiratory mobility of the bronchial was probably of chief importance in the rup of the lymph node.

The sudden appearance of tubercle bacill the pulmonary secretions, with or witho sudden concomitant pulmonary spread, has found to be of real diagnostic significance. W such phenomena occur in the presence of a g eralized lymphohematogenous tuberculosis o the presence of a widened mediastinal roen shadow, thought to be due to tuberculous lym denitis, the possibility of a perforation of tracheobronchial tree by a caseous lymph n should be immediately considered.

Sea View Hospital.

ADENOMA OF THE CERUMINOUS GLANDS

H. J. ADLER, M.D., AND I. SOMMER, M.D.
CHICAGO

Adenoma of ceruminous glands has rarely been ported. The first such report was made by ug[1] in 1894. He called an adenoma acino- n of sebaceous glands a tumor akin to ade- ma of ceruminous glands. The tumor was in a n 35 years old in whom the only abnormal ding was a growth in the entrance of the ernal auditory canal. Microscopic exami- ion revealed a tumor composed of glandular veoli with fibrous septums showing (1) alveoli ed with epithelial cells which were larger at e periphery and smaller toward the lumen and) vacuolated alveoli lined with a double row epithelial cells. This second pattern he re- rded as an abnormal pattern of sebaceous nd structure.

Haug described a second case as one of denocarcinoma of the aural sweat glands with xomatous degeneration of the stroma" in a n whose only abnormality was an ulcerated dule of the external auditory meatus with ociated regional adenitis. Microscopically, it sisted of strands of polygonal granulated thelial cells. These strands and tubular ndular structures were surrounded by carci- ma cells. The tubular glands were long and d with homogeneous epithelial cells in one two layers. Some of these were typical of the h prismatic epithelium of the ceruminous nds.

In 1913 Ruttin[2] reported a case of tumor of uminous glands. He stated that he was un- e to differentiate between true adenoma and tation of ceruminous glands.

Not until 1926 was there a report of a thor- hly studied case of adenoma of ceruminous nds. This was contributed by Brock:[3]

A woman aged 53 had been seen first in 1921. She been operated on for a small tumor of the ear 1909, when she allegedly had otorrhea. Four years later the tumor recurred, and the ear again discharged. This condition continued up to 1921, when a moderately hard tumor covered by normal skin was removed. It sprang from the anterosuperior cartilaginous wall of the outer meatus, to which it was attached by a pedicle. The tumor was removed without difficulty. It weighed 4 Gm. and measured 34 by 30 mm. The outer meatus was found to be greatly dilated and contained a foul discharge and a calculus measuring 1 by 6 by 6 mm., consisting of calcium phosphate, fat and unsaturated fatty acids. The condition of the membrana tympani and that of the middle ear are not mentioned. Histologically, the tumor consisted mainly of adenomatous glands, whose lumens varied greatly in size, some showing cystic dilatation. The epithelial cells were arranged mainly in two rows. Both the walls of the cells and their protoplasm were indistinct. The amount of protoplasm between the nuclei of the cells and the wall of the lumen was greatly diminished. The nuclei were homogeneous and well preserved. The peripheral layer of these cells was flat and rectangular in shape, whereas the inner layer was more spherical in shape.

Brock considered his case unique.

In 1927 Ruttin[4] published an extensive account of the case he reported in 1913.

A 14 year old boy, first seen in 1912, had aural polyps removed six years prior to examination for tumor and had noted intermittent otorrhea since. Ruttin found a discharging ear and a tender tumor springing from the floor of the outer meatus. Operation (retroauricular incision) showed the tumor inserted in the meatal floor extending to the tympanum. Postoperative acute otitis media developed, which required two more operations. Histologically, the tumor was covered with normal skin. In the subcutaneous layer normal ceruminous glands were present, below which dilated tubular ceruminous glands were found. The cells lining these tubules were flattened. The rest of the tumor consisted of dilated ceruminous glands reaching cystlike proportions.

In 1933 Nichinson[5] published a case.

A 25 year old man had been hard of hearing for three months. The previous aural history indicated no disease of the ear. A tumor was found attached by a 4 mm. pedicle to the posterior and upper cartilaginous wall of the outer meatus. The tumor, measuring 15 by 6 mm., was covered by skin. It was removed with a cold snare. The surface was of papillary character and connected to the subcutaneous tissue

From the Chicago Eye and Ear College.

1. Haug, R.: Beiträge zur Klinik und mikroischen Anatomie der Neubildungen des äusseren mittleren Ohres, Arch. f. Ohrenh. **36**:170, 1894.
2. Ruttin, E.: Tumor bestehend aus Ceruminalen, Monatschr. f. Ohrenh. **47**:1438, 1913.
3. Brock, W.: Zeruminaldrüsenadenom des Gehörges, Ztschr. f. Laryng., Rhin., Otol. **14**:349, 1926.
4. Ruttin, E.: Zeruminaldrüsenadenom, Monatschr. f. Ohrenh. **61**:751, 1927.
5. Nichinson, A. G.: Ein Fall einer Epithelgeschwulst des äusseren Gehörganges, Monatschr. f. Ohrenh. **67**:210, 1933.

by peculiar rodlike structures. These rods contained cysts, some empty and some filled with detritus composed of small hornified cells derived from the stratum proprium corneum. The author diagnosed the condition as cystic adenoid epithelioma, with an alternate diagnosis of trichoepithelioma papulosum. He compared this structure with Reklus' disease (polycystoma of the mammary gland). He was unable to find a similar case described in the literature and ventured the opinion that the tumor he described may belong to the class known as hamartoma, hamartoblastoma or basaloma.

In 1939 Sprenger and Prietzel [6] described an adenoma of ceruminous glands.

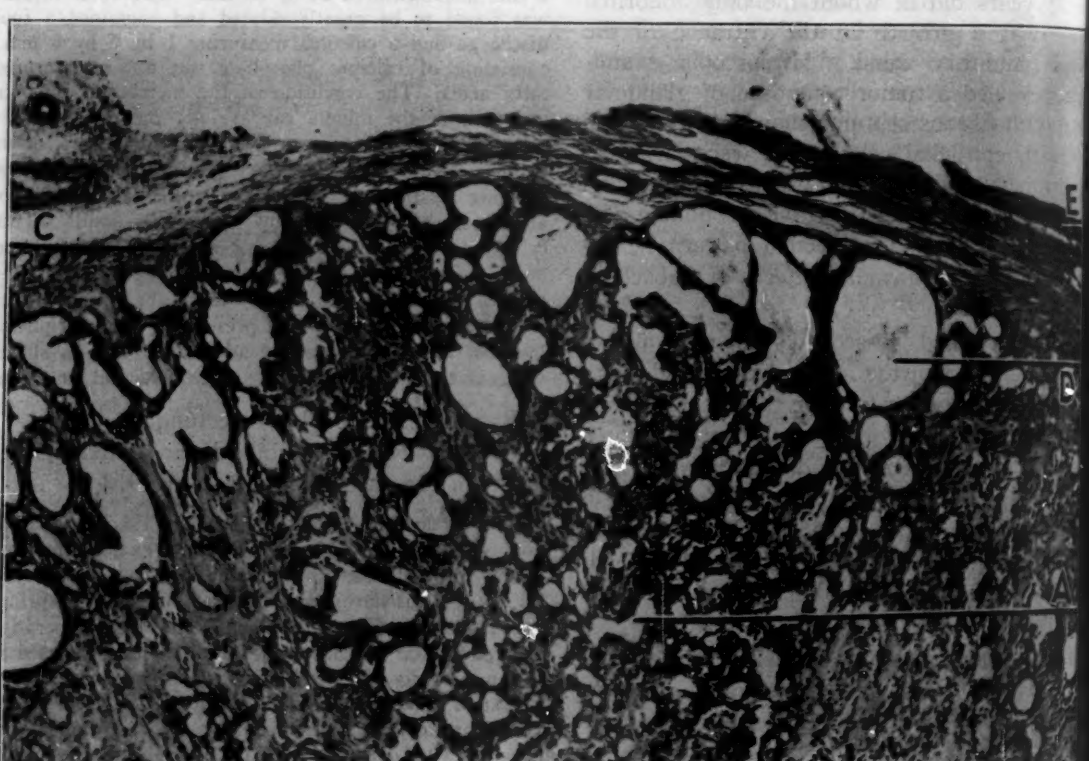


Fig. 1.—Photomicrograph; 1×50. *E* indicates epithelium of the external auditory canal; *D*, dila ceruminous glands; *A*, adenoma; *C*, capsule.

The patient was a man 50 years old who had complained of a loss in auditory acuity with slight otalgia for one year. A tumor was found coming from the anterosuperior wall of the external auditory canal. It was covered with normal skin. It was removed by the retroauricular route. Histologically, the tumor consisted of tubules, connective tissue and solid rodlike formations. The epithelial lining of the tubules was composed of one to two layers of cells, the protoplasm of which was difficult to differentiate. Although the nuclei contained a slight amount of chromatin, they stained well. They were either spheroid or ovoid and contained a nucleolus. The tubules contained granular and hyaline masses. Certain sections of the slides showed alveoli with cystlike dilatations. The alveolar wall was formed by a double row of epithelium. T alveolar contents took a faint eosin stain. There w also variously shaped cell nests, the periphery of wh was formed mainly by the epithelial cells descri Centrally the cell nests contained cells with nuclei either ovular or staff shape. These central cells w rich in chromatin. The authors concluded that t histologic picture is that of an abnormal epidermal gl and therefore must be considered blastomatous.

REPORT OF OUR CASE

M. A., a 51 year old welder, noticed twelve ye ago a pressure in his right ear. The hearing beca progressively worse but could be influenced by retra tion of the auricle. Six years ago some sort of ope tion was performed with the patient under gene anesthesia, through the external auditory canal, w no success. Two weeks later constant tinnitus de oped, which was still present at the time of exami tion. Examination revealed a small palpable m beneath the normal skin of the posterior wall of external auditory meatus, causing narrowing of canal to a fine slit at that point and permitting admission of a probe of not more than 22 gage. Th was no discernible scar. There was no discha Audiometry showed conductive deafness. With patient under local anesthesia, the bony meatus exposed by way of a postauricular incision. No abn malities of the bone were found. The tumor m proved to be in the skin of the outer meatus. It removed in one piece. It measured 7 by 6 by 4 m Cerumen and epithelial detritus were found behind flush up to a normal drum. The postauricular wo was closed in layers. It healed by first intenti

6. Sprenger, W., and Prietzel, F.: Zeruminaldrüsenadenom des aüsseren Gehörganges, Monatschr. f. Ohrenh. **73**:722, 1939.

covery was uneventful, and hearing was completely stored.

Microscopic examination revealed a tumor covered th normal skin. Many ceruminous glands were esent in the subcutis. They had a lining of one or o layers of epithelial cells, ranging from cuboidal cylindric. The inner layer had the longer cells; e outer layer, the flatter ones. In the inner layer e protoplasm contained granules of different shades yellow and brown. Many of these tubular glands owed various degrees of dilatation, in some of which e epithelium was flattened (fig. 1).

The tumor arose from these glands. It had a fairly tinct fibrous capsule, which merged with the subtis. The tumor consisted in large measure of alveoli

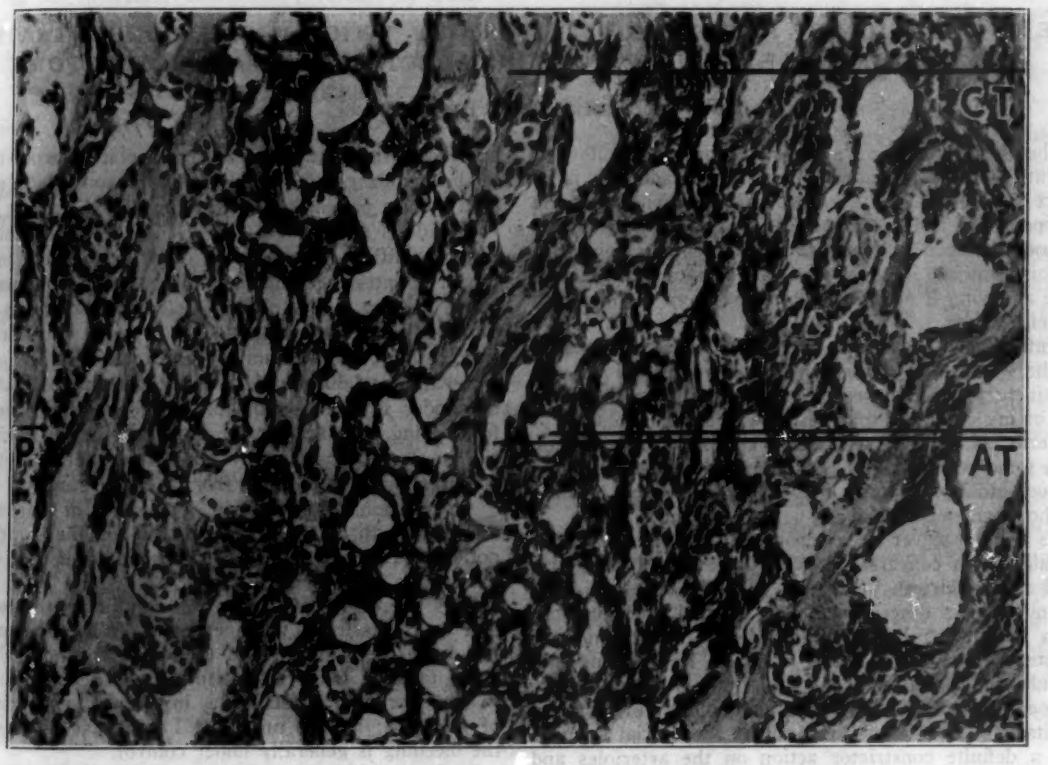


Fig. 2.—Photomicrograph; 1×105. *AT* indicates alveoli and tubules; *P*, pseudosolid strands; *CT*, nnective tissue.

d tubules of various dimensions, lined with one or o rows of epithelial cells. The protoplasm of these ls appeared mostly granular, with oval or round clei. The chromatin was distinct. In many instances e round nucleus contained a large nucleolus. In me of the alveolar lumens desquamated cells and rillar or granular masses were discernible. A large rt of the tumor was composed of pseudosolid strands. ese appeared as irregularly arranged cellular nests th oval or spindle-shaped nuclei, interspersed and fined by small alveoli. In some of the more regular nds the nuclei were arranged in longitudinal rows, d here and there a slitlike lumen was visible. In me areas the tubules were confluent and resembled stadenoma. The interalveolar and intertubular spaces re filled with granular, hyaline and myxomatous nnective tissue, which formed septums of various mensions (fig. 2).

COMMENT

The evidence is in favor of an adenoma of ceruminous glands. The dilated glands showed the typical structure of normal ceruminous glands, with their double row of epithelial cells and their granular protoplasmic content. The tumor proliferated from these glands, showing alveolotubular structure and pseudosolid epithelial strands. It was a noncancerous new growth, interfering with hearing by obstructing the external auditory meatus. There was no tendency to infiltrate the surrounding tissue.

The literature reveals only 2 proved cases of adenoma of ceruminous glands, the case of Brock and the case of Sprenger and Prietzel. Many authoritative textbooks of pathology do not mention it. The complaints and the clinical and laboratory findings were strikingly similar in all the cases. The cases of Haug, Ruttin and Nichinson were not proved, although the likelihood is great that they fall into this group.

CONCLUSION

The case reported is the third proved case of adenoma of ceruminous glands to be recorded in the literature.

231 West Washington Street.

Clinical Notes; New Instruments and Technics

USE OF SOLUTION OF POSTERIOR PITUITARY OF TWICE U. S. P. CONCENTRATIO FOR HEMORRHAGE FOLLOWING TONSILLECTOMY OR ADENOIDECTOMY

J. W. McLaurin, M.D., Baton Rouge, La.

The best insurance against hemorrhage following operations for the removal of tonsils and adenoids is an exact and painstaking surgical dissection with adequate preoperative and postoperative care to keep down secondary infection. In spite of conscientious adherence to this principle, from 3 to 4 per cent of patients will have annoying if not serious bleeding from the fourth to the eighth day.

Until 1941 I had used all of the technics suggested in the literature for this type of bleeding. None was satisfactory for one reason or another. At that time one of my confreres told me he was using a solution of posterior pituitary of twice the U. S. P. concentration with some good results. Since then I have learned from various otolaryngologists that it is a dependable member of their armamentarium.

Its use has never been reported in the literature, but I judge from conversation with other men it was first used about thirteen years ago. Therefore, this is not submitted as a description of an original procedure but as a helpful clinical note to call to the attention of practitioners a technic that has been time saving and useful in my practice.

Goodman and Gilman [1] stated that solution of posterior pituitary of double the strength of the official solution has a definite constrictor action on the arterioles and capillaries and that its action on the heart is variable but that there is a definite decrease in flow of blo in the coronary arteries. For this reason I have ne used it for a patient suspected of cardiac disease.

To adults 5 minims (0.31 cc.) is given intramus larly; in fifteen minutes this dose is repeated, and fifteen minutes the remainder of the cubic centimeter given. If any clot is present, it is removed with a r forceps. For children the dose is varied according size; usually 8 to 10 minims (0.49 to 0.61 cc.) is giv One-half is administered, and twenty minutes later remainder is given. This procedure has been used forestalling the bleeding of both tonsils and adeno and so far has practically eliminated the necessity postnasal packs in bleeding from adenoidectomy.

An occasional side reaction in the form of an abdor nal pain with immediate movement of the bowels noticed. This pain is of short duration and over wh the bowels have moved.

This simple technic saves rehospitalizing the pati and the necessity of an anesthetic. When the pati has become frightened and gone into the hospital a I am familiar with the patient's general condition, nurse is ordered to start the injection of the soluti of pituitary; by the time that I arrive at the hospi the bleeding is generally under control.

In the last three years I have used the drug in 21 ca of hemorrhage secondary to adenoidectomy and tons lectomy with most gratifying results. It is easily adm istered to both children and adults, since it is giv intramuscularly and not intravenously.

1. Goodman, L., and Gilman, A.: Pharmacological Basis of Therapeutics, New York, The Macmillan Company, 1941, p. 663.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

CONTRIBUTIONS TO PLASTIC SURGERY DURING 1943

LYNDON A. PEER, M.D.
NEWARK, N. J.

e general trend of the literature on plastic ery for 1943 shows a heightened interest in epair of large losses of tissue similar to those rring in warfare casualties; relatively few es deal with minor or cosmetic deformities. rther work is reported in the investigation e sulfonamide compounds, including sulfazine, which is a new member of the group. here are also contri utions to the knowledge enicillin, propamidine (4, 4'ₛ-diamidinodioxypropane hydrochloride) and tyrothricin. eons who desire to keep informed regardhis revolutionary phase in the war against iful bacteria should study these reports.

e literature also contains publications dealwith tissue healing. A review of these conions has been included in the 1943 survey se of their importance to all medical men her in special or in general fields of surgery.

SULTS OF CLINICAL AND LABORATORY RESEARCH—GENERAL PRINCIPLES

ERAPY WITH SULFONAMIDE COMPOUNDS AND OTHER SUBSTANCES

ooney and Taylor [1] advise the use of gauze impregnated with 5 per cent sulfathiazole latum ointment to cover surgical incisions. tested the stability of this preparation by ng gauze strips in a pan of the ointment terilizing the pan in the autoclave for fortyinutes at a pressure of 20 pounds (9 Kg.). ical examination of the sulfathiazole after riod in the autoclave showed no evidence of nposition due to sterilization. The authors that sulfathiazole petrolatum gauze applied ured wounds induces faster healing and prethe formation of stitch abscess. (Comment: is no evidence that sulfathiazole applied wound accelerates the healing of the wound t indirectly by preventing bacterial growth.)

According to Schmelkes,[2] the effectiveness of the sulfonamide compounds is greatly influenced by the hydrogen ion concentration of their environment. The presence of some polar compounds, such as urea and asparagin, increases the activity of the sulfonamide compounds. Oxidizing agents, such as azochloramid, have a similar effect.

In an editorial comment Herrell [3] states that the local use of sulfonamide preparations is an exceedingly valuable procedure in the prophylaxis and the treatment of wounds. Of the many compounds available, sulfanilamide, sulfadiazine and sulfathiazole are probably the drugs of choice for local use. Sulfanilamide is less irritating to the wound, but sulfathiazole has a wider range of antibacterial activity. Sulfathiazole should be applied as a thin coating over the affected area rather than "packed" in the wound, to avoid irritation and a reaction of the foreign body type. The efficacy of sulfadiazine compares favorably with that of sulfathiazole but, according to recent investigation, sulfathiazole is the superior drug. The author warns that pus and tissue exudate will prevent the antibacterial activity of sulfonamide compounds applied locally. He therefore recommends frequent cleansing of infected surfaces followed by reapplication of the powdered drug.

On the basis of experimental work with rabbits Casten and others [4] conclude:

1. The bacteriostatic activity of sulfathiazole can be inhibited in vitro by many agents, the most potent of these inhibitors being para-aminobenzoic acid and its derivatives.

2. Many local anesthetic agents in common use are derived from para-aminobenzoic acid. Pro-

Mooney, V., and Taylor, F. A.: The Use of hiazole Vaseline Ointment, Am. J. Surg. **59**:554 h) 1943.

2. Schmelkes, F. C.: Chemical Considerations Governing the Local Chemotherapy of Wound Infections, Surg., Gynec. & Obst. **77**:69 (July) 1943.

3. Herrell, W. E.: The Local and Intraperitoneal Use of Sulfonamide Compounds, editorial, Surg., Gynec. & Obst. **76**:247 (Feb.) 1943.

4. Casten, D.; Fried, J. J., and Hallman, F. A.: The Inhibitory Effect of Procaine on the Bacteriostatic Activity of Sulfathiazole, Surg., Gynec. & Obst. **76**: 726 (June) 1943.

caine is probably the member of this group used most frequently.

3. This experimental work has shown conclusively that procaine will inhibit the bacteriostatic activity of sulfathiazole in wounds inoculated with a suspension of Staphylococcus aureus at the time of trauma.

Hall and Spink [5] discuss the clinical evaluation of sulfamerazine, which is a monomethyl derivative of sulfadiazine. They used sulfamerazine in the treatment of 116 patients who had a variety of clinical conditions; 16 of the patients were infants under 1 year of age. The authors state that sulfamerazine appeared to be as effective as sulfadiazine in the therapy of 40 patients with pneumococcic pneumonia or bronchitis. Sulfamerazine was less effective than sulfathiazole in the treatment of staphylococcic sepsis. Thirty-three patients with streptococcic infections responded as well to treatment with sulfamerazine as a comparable group did to the use of sulfadiazine. Sulfamerazine did not appear to be any more toxic than sulfadiazine and did not produce any demonstrable neurologic complications.

Crowe and his associates [6] report on the use of penicillin and tyrothricin for various bacterial infections. Penicillin is an antibacterial substance produced by the growth of certain strains of the mold Penicillium notatum. Tyrothricin is a bactericidal substance isolated from peptone cultures of the aerobic soil bacterium Bacillus brevis of Dubos. The authors believe that experience with these two new microbiotic agents is still in the experimental stage but that the preparations promise to become valuable additions to the group of drugs now used for the prevention or the cure of infections in burns, lacerated wounds and other local conditions.

In the opinion of Clark and his co-workers [7] hemolytic streptococci and other pyogenic cocci play a dominant role in delaying the healing of body burns. Daily powdering of the burned area with sulfanilamide frequently eliminated hemolytic streptococci after four or more days, but this therapy was followed by the development of sulfanilamide-resistant strains of bacteria. Daily application of the drug to burns caused discomfort to the patient, disturbed the progress in healing of the wound and was not without danger from excessive absorption of sulfanila into the system.

These considerations led the authors to penicillin and propamidine as alternative ag in successfully combating staphylococci and h lytic streptococci in burns.

Penicillin was applied in a cream mix directly to the burned surface, and the app tion was repeated at intervals of forty-eight h Hemolytic streptococci disappeared from burns in 76 per cent of the cases within and one-half days after the first application did not reappear after treatment was dis tinued. Staphylococci also were eliminated marily of the wounds, but coliform, proteus pyocyaneus bacilli when present usually pers in the wounds despite this form of treatm

Propamidine in a cream was also ap directly to the burned areas. The hemo streptococci disappeared rapidly in 62 per of the cases. In the concentrations used prop dine appeared to have less influence on the st lococci than did penicillin. The gram-neg bacteria were not affected by the use of pamidine.

Keefer and others [8] found penicillin t extremely useful in the treatment of infec due to staphylococci, hemolytic streptococci, p mococci and gonococci. The use of penicill particularly beneficial in cases of infectio which the bacteria are resistant to the su amide compounds. The authors conclude penicillin is a remarkably potent antibact agent which can be given intravenously, i muscularly or topically. It is ineffective given by mouth.

MANAGEMENT OF BURNS

Ravdin [9] stresses the importance of reli pain in cases of burn and of administ early replacement therapy for shock by m of plasma, serum, human albumin or some adequate blood substitute. Whole blood t fusions during this early period may be har for plasma continues to be lost from the vas system, while the red cells remain in the culation. The addition of whole blood will t fore increase the concentration of the ce elements, which are already concentrated i small an amount of plasma.

Discussing local treatment for burns, R states that there is no agreement among aut ties in this or any other country as to the

5. Hall, W. H., and Spink, W. W.: Sulfamerazine, J. A. M. A. **123**:125 (Sept. 18) 1943.

6. Crowe, S. J.; Fisher, A. M.; Ward, A. T., Jr., and Foley, M. K.: Penicillin and Tyrothricin in Otolaryngology, Ann. Otol., Rhin. & Laryng. **52**:541 (Sept.) 1943.

7. Clark, A. M.; Colebrook, L.; Gibson, T., and Thomson, M. L.: Penicillin and Propamidine in Burns, Lancet **1**:605 (May 15) 1943.

8. Keefer, C. S.; Blake, F. G.; Marshall, Jr.; Lockwood, J. S., and Wood, W. B., Jr.: cillin in the Treatment of Infections, J. A. M. A. 1217 (Aug. 28) 1943.

9. Ravdin, I. S.: The Burn Problem, Am. J. **59**:330 (Feb.) 1943.

nt. He advises careful débridement of se-ly devitalized tissues under aseptic condi-s and emphasizes that extensive scrubbing cedures cause increased shock. He cautions inst the use of tanning solutions for the face, hands or the genitalia since application of ning agents to these areas has led to much ess deformity. Skin grafts should be applied reas of third degree burns as soon as possible educe the incidence of infection and minimize equent deformity.

n Koch's [10] opinion there is little argument ng surgeons as to the necessity of anticipat-and combating shock in cases of burns, and hods of doing so are fairly well agreed on. ortunately, as yet there is little accord con-ing the most satisfactory method for local ment of burns. Koch advises thorough sing of the burned area with soap and r and complete débridement with sterile in-ments. The wound is then covered with latum-impregnated gauze, sterile dry gauze mechanic's waste and a firm pressure dress-applied. The author believes that the pres-dressing arrests the seeping of fluid from burned surface and also checks the escape rum from the blood vessels into the tissues, preventing or lessening the shock suffered e patient.

irshfeld and his associates [11] compared the ions of normal tissues to tanning acid and etrolatum-impregnated gauze by applying to donor sites of persons who were receiv-kin grafts. On inspection it was found that onor sites treated by petrolatum gauze healed quickly than those treated with tannic acid. study was made of tissue reactions to the aments in some cases during a period rang-rom several hours to ten days, biopsy speci-being taken from the treated donor sites. as demonstrated that the tanning agents oyed the dermis to a great depth, while latum gauze produced no visible damage of dermis except in patients showing some ion.

nnon and Cope [12] tested the value of various s recommended for the treatment of a dé-d burned surface. They applied the various s to donor areas from which skin grafts been removed with the Padget dermatome and observed the rate of epithelial regeneration, using similar areas covered with boric ointment as controls. They conclude that tannic acid and silver nitrate, gentian violet (methylrosaniline chloride), the triple dyes and triethanolamin solutions delay epithelial healing as compared with the control boric acid ointment.

Forbes and Evans [13] gave tannic acid to rats subcutaneously and later killed the rats and made sections of the livers. They observed fairly uniform central necrosis of the livers in these sections. The administration of sulfanilamide did not protect the animals against hepatic necrosis.

Elman [14] made a statistical analysis of 78 fatal cases among 427 cases of severe burns, with special reference to the probable influence of therapy on the early mortality rate. It seemed clear to him that the following three factors alone or in combination contributed to early mortality: (1) the use of noncoagulation methods of therapy, (2) the failure to use plasma transfusion at all or in adequate amounts and (3) the failure to precede local by systemic therapy.

The author believes that the reduction in early mortality rate depends on giving rigid priority to methods which minimize or prevent loss of plasma.

Farmer [15] describes the treatment of 1,800 acute burns and states that there has been a progressive rapid fall in the mortality rates during the last three decades. The first great reduction was coincident with the use of tannic acid. Following this there was a gradual decline in the mortality rates until the final period, when again a sudden rapid reduction occurred that was coincident with more intensive early general treatment.

Farmer concludes that while there is as yet no ideal local application for all burns, the changing of a large wet wound, often painful, into a dry comfortable surface (through the application of such a substance as tannic acid) remains an excellent form of therapy.

In Sheehan's [16] opinion a comparison of the treatment of burns in the present war with that in other wars shows two new features of interest. One is the availability of plasma as an adjunct for the control of shock that results from severe burns. The other is the use of the sulfonamide

Koch, S. L.: Injuries in the Parietes and Extremi-Surg., Gynec. & Obst. **76**:1849 (Jan.); 189 (Feb.)

Hirshfeld, J. W.; Pilling, M. A., and Maun, : A Comparison of the Effects of Tanning and of Vaseline Gauze on Fresh Wounds of Surg., Gynec. & Obst. **76**:556 (May) 1943.

Cannon, B., and Cope, O.: Rate of Epithelial eration, Ann. Surg. **117**:85 (Jan.) 1943.

13. Forbes, J. C., and Evans, E. I.: Tannic Acid and Liver Necrosis, Surg., Gynec. & Obst. **76**:612 (May) 1943.

14. Elman, R.: Early Mortality of Burns as Influenced by Rapid Tanning and by Transfusions, Am. J. Surg. **117**:327 (March) 1943.

15. Farmer, A. W.: Experience with Burns at the Hospital for Sick Children, Am. J. Surg. **59**:195 (Feb.) 1943.

16. Sheehan, J. E.: Burns as War Wounds, Am. J. Surg. **61**:331 (Sept.) 1943.

compounds and some other preparations in the control of infection. Both procedures have had an influence on current practice that can be properly described as revolutionary.

Cope [17] reports on the treatment of 39 patients brought to the emergency ward of the Massachusetts General Hospital from the fire at the Cocoanut Grove night club. Local therapy in these cases consisted of application of sterile boric acid ointment strips secured on the burned surfaces by pressure bandage without any preliminary débridement or cleansing. Shock and anoxia were treated by general measures, and sodium sulfadiazine was given intravenously. On the basis of clinical observation Cope concludes that healing occurred as rapidly beneath the unruptured blebs as under any of the agents commonly recommended for burned surfaces.

Rabinowitch [18] states that when phosphorus comes in contact with the skin and is allowed to cause a burn it produces almost immediately a grayish discoloration of the affected part. The initial pain is severe. The phosphorus tends to become embedded in the skin; the phosphorous acids that are produced penetrate still deeper. Blisters are rare, but phosphorus burns suppurate more than ordinary burns and heal slowly.

In the field, contaminated clothing is removed at once, and the affected parts of the skin are flushed with warm water. Visible particles of phosphorus are removed with forceps while the skin is being flushed, and a thick pad soaked in warm water is applied over the affected area.

At the first aid post the affected parts are flushed with a warm solution of sodium bicarbonate to neutralize and render harmless any remaining phosphorous acids. The traces of phosphorus are then washed away with a 1 per cent solution of copper sulfate, which reacts with the phosphorus to form nonignitable black copper phosphide. Finally the affected areas are washed with a water solution containing a little antiseptic medicament and a sterile dressing is applied.

For phosphorus burns in the neighborhood of the eyes the safest procedure is to wash the parts well with warm water and apply a mask of lint soaked in sodium bicarbonate solution. A fresh application of the alkaline solution should be made every four hours.

GENERAL THERAPY

In an excellent review Localio and his associates [19] list general and local factors which influence the healing of wounds.

General Factors.—(*a*) Age: In aged patients ing is delayed.

(*b*) Temperature: Within limits increased tem ture increases the rate of healing, probably th acceleration of the chemical reactions in the w Sympathectomized areas heal faster than do c wounds, partly because of the increased tempe in the sympathectomized area.

(*c*) Water Balance: Dehydration of tissues c impairment of the circulation and nutritional ch results in delayed healing. Hyperhydration d edema of the tissue and has much the same effe dehydration.

(*d*) Acidosis and Alkalosis: Normally the h wound is acid in reaction, and there is experim evidence demonstrating that putting the patient o alkaline diet delays healing of the wound.

(*e*) Hormones: Reports in the literature on effect of the administration of hormones, such as ticular hormone or gland, on the healing of w are contradictory.

(*f*) Nervous Influences: More rapid healin wounds is supposed to follow sympathectomy, to the vasodilatation and the increased peripheral sure and temperature. Recently this concept has applied in the treatment of wounds in certain ca peripheral vascular disease.

(*g*) Neutropenia: In animals experimentally in neutropenia does not affect the healing of an a wound. In the presence of infection the healing p is delayed.

(*h*) Disease: Many coexisting diseases have a terious effect on the healing of wounds, owing to ciated anemia, low plasma protein and other fa

(*i*) Diet: The healing of wounds will occ starving animals at the expense of less active or the organism. Healing is greatly delayed in f animals. There is a moderate delay when animal given a high carbohydrate diet. Only a short occurs in the healing of wounds when the experim animals are put on a protein diet.

(*j*) Hypoproteinemia: Animal experiments that lowered plasma protein produces prolonged in the healing of wounds.

(*k*) Vitamins: The available evidence indicates the ingestion of vitamins A and C is essential t healing of wounds. The presence of vitamins E E in the body may be necessary, but vitamin D no apparent effect except to cause delay when ad istered in large doses.

Local Factors.—(*a*) Trauma: Rough handli tissue, mass ligation, undue retraction and fo blunt dissection cause numerous islands of ne The presence of this necrotic tissue leads to del the healing of wounds. The islands of necrotic also constitute a favorable environment for the p eration of bacteria, which are present in all w

(*b*) Blood Supply: Restriction of the blood s to any wounded area greatly retards healing.

(*c*) Hematomas: Hematomas interfere with healing of wounds by preventing apposition o wound edges, by prolonging the phase of destru

17. Cope, O.: The Treatment of the Surface Burns, Ann. Surg. **117**:885 (June) 1943.

18. Rabinowitch, I. M.: The Treatment of Phosphorus Burns, Canad. M. A. J. **48**:291 (April) 1943.

19. Localio, S. A.; Casale, W., and Hinton, J. Wound Healing: Experimental and Statistical S Internat. Abstr. Surg. **77**:457, 1943; in Surg., Gyn Obst., December 1943.

by acting as a culture medium for bacteria. Furmore, the formation of a clot interferes with the l circulation by producing pressure on the vessels.

(d) Chemicals: The use of chemicals for antisepsis inadvisable when such antiseptic agents are capable destroying exposed tissues.

(e) Electrosurgery: After electrosurgery or electrogulation has been applied for hemostasis, the destruce phase is prolonged and thus healing of the wound delayed.

(f) Suturing: Suturing with undue tension causes rosis along the suture line.

(g) Dehydration: Exposure of wounds to the warm air of the operating room and the heat from the ense lights necessary for operating causes dehydran and death of the superficial layers of the exposed as. This produces additional formation of necrotic ue in the wound, which prolongs the healing process.

(h) Infection: Meleney has estimated that from 00 to 60,000 bacteria fall on a sterile field during course of a one hour operation. This contamina- is usually air borne and is the result of inadequate sking and the presence of dust traps, air currents street clothing. Obviously, in this manner a large centage of clean surgical wounds become contamted. The healthy wound can exterminate bacteria cessfully, but a wound containing old blood, serum devitalized tissue affords a favorable soil for the wth of bacteria. Experience in World Wars I II has demonstrated the necessity for excising italized, traumatized and contaminated tissue in order obtain primary healing of traumatic wounds.

(i) Immobilization and Rest: Motion of the wounded t during the lag period of healing disrupts the fibrin dge and prolongs the lag period. During the phase cell proliferation motion may stretch the newly med scar.

(Comment: This article by Localio and his sociates is an important contribution and should read in the original.

All of the factors which they mention as affecting healing of wounds apply to facial lacerations well as to wounds elsewhere in the body.

The authors advise thorough débridement of unds, with removal of contaminated and traumatized tissues. This is good practice for lacerans in general, but the débridement should be nservative in facial injuries, where wide excin may cause permanent deformity. The tisues of the face possess a remarkable ability to stroy bacteria, and therefore in this locality rough débridement is not necessary.

One should remove the sutures in facial wounds er a period of three to four days in order to vent the development of stitch scars. The taneous edges are then cleansed with ether and efully drawn together with adhesive tape that been passed through a flame, to prevent aration of the edges of the wound or widening of the scar. One should never use wide axing sutures in facial lacerations. The use such sutures frequently gives rise to stitch rs, which can never be satisfactorily repaired. A wide scar can be excised at a later operation, but suture scars in the skin at some distance from the wound create a permanent deformity.)

An interesting discussion of "The Thymus Problem" that took place at a clinical meeting at the Mosher Laboratory of the Massachusetts Eye and Ear Infirmary is reported.[20] An imposing list of experts testified that there occurred or did not occur such a condition as status lymphaticus associated with enlargement of the thymus gland. Mosher and others contended that there was such a clinical entity, that a preoperative roentgenogram of the thymus in such cases showed an enlargement of the gland and that the enlarged organ could be reduced in size by roentgen treatments, thus rendering the patient a safer operative risk.

Expressing a contrary view, Dr. Allen Butler argued that there are many pathologists who believe that no justification exists for the diagnosis of status lymphaticus and that the cause of death must be found elsewhere in the body. According to Dr. H. K. Beecher, many cases of so-called thymus death may be explained on the simpler basis of poor anesthesia. When the administration of anesthesia has improved, the number of mysterious deaths has decreased.

In conclusion Dr. Mosher claimed that if a lawsuit should occur following a sudden death, the hospital or the chief of staff might be held liable if a preoperative roentgenogram of the thymus gland had not been taken in order to ascertain the condition of the gland. Until more definite knowledge on the subject is available, preoperative roentgenograms of the thymus gland are indicated to prevent potential casualties.

Wakim and Gatch,[21] on the basis of experimental work with animals, conclude that the application of heat is stressed too much in the treatment of shock. They observed that the survival time of anesthetized animals in experimental shock was greatly shortened by the application of heat or cold, while it was much longer for the animals that were kept at room temperature and for those placed on warm water bottles slightly above room temperature, after shock had been produced. The authors conclude that heating or chilling shocked animals is harmful, while keeping them comfortably warm contributes favorably to their survival.

In Patterson's[22] opinion parotitis is a serious condition when it is a complication of surgical

20. The Thymus Problem, Ann. Otol., Rhin. & Laryng. **52**:752 (Sept.) 1943.

21. Wakim, K. G., and Gatch, W. D.: The Effect of External Temperature on Shock: An Experimental Study, J. A. M. A. **121**:903 (March 20) 1943.

22. Patterson, D. C.: Postoperative Parotitis with Radiation Treatment, Am. J. Surg. **59**:172 (Feb.) 1943.

procedures. Statistics collected previous to the institution of radiation therapy show a mortality rate of more than 50 per cent for postoperative parotitis, or "surgical mumps." The cause of this condition is not known, but the disease may follow any type of operation whether septic or not. Patterson emphasizes the necessity for early diagnosis since early treatment reduces the mortality. The use of the sulfonamide compounds may be of some value, but roentgen therapy is the most effective form of treatment.

In a series of 31 cases of shock Melton [23] made observations that lend support to the view generally held that the administration of oxygen is of benefit, particularly in cases of severe shock. He emphasizes that in the latter cases the giving of oxygen can in no way replace more important methods of treatment, such as plasma transfusion; it is to be regarded as a supplement to such treatment.

Figi and his co-workers [24] state that serious results may follow inadequately controlled radium and roentgen therapy or the injudicious use of roentgen rays for diagnostic purposes. The resultant radiodermatitis often produces severe disability and marked deformity, and its tendency to undergo cancerous change has even more serious import.

Conservative measures are indicated in the acute stages of radiodermatitis and in the mild chronic lesions, but when secondary changes due to irradiation are pronounced, surgical removal of the affected tissue affords the only means of relief. Following excision of the altered tissue, the wound is closed by primary suture, but if this is not feasible, application of a free graft or use of a sliding flap or a pedicle flap is required.

(Comment: This article is an important contribution and should be widely read. The large number of patients with radiodermatitis of the skin following radium or roentgen treatment for a simple noncancerous condition is disturbing to thoughtful physicians. Something is definitely wrong, and the responsibility in most cases rests with the physician giving the roentgen or radium therapy.

As emphasized by Figi and his associates, cutaneous areas affected by radiodermatitis are not merely unsightly; they are dangerous as well, since a large number of such areas later undergo cancerous change. The condition therefore constitutes a potential threat to the life of the patient.

Statistics on the percentage of cancers devel ing in areas of radiodermatitis vary consid ably, but they are alarmingly high. Since malignant lesion usually develops slowly ove period of years, operative removal is indicat especially in young persons with a long expectancy. Older patients affected with ra dermatitis may not live long enough for ma nant change to develop in the affected are

Sutton [25] gives a concise description of role of plastic surgery in the treatment of wounds. He believes that the casualty pati from the field of battle has a right to experien care for facial injuries, since his later success the competition of peacetime living will be fluenced by his facial function and appearan Sutton concludes:

1. Facilities for postgraduate training in pla surgery should be augmented to meet the mands for surgeons properly trained in specialty.

2. The war casualty should receive the be fit of modern methods of reconstruction si the preliminary treatment may determine the come of later reconstruction.

3. Conservation of tissue is important in care of wounds and compound fractures of face.

4. Early grafting of skin is essential in treatment of large deep burns.

5. Contracted scars should be relaxed by sh ing flaps, and skin grafts should be used only an alternative.

6. Immediate grafting for certain wou should be considered as a means of prevent deformity and shortening the period of disabil

An editorial in *The Journal of the Ameri Medical Association* [26] states that vitamin d ciency may occur in man or animals despite presence in the diet of a normally adequate amo of the appropriate vitamin. Perhaps the m widely known example of this is the occurre of vitamin K deficiency, which is characteri by a low prothrombin level in the blood an consequent tendency to hemorrhage in man animals when bile salts are prevented from rea ing the intestine. Whether present in the or synthesized by intestinal micro-organisms, soluble vitamin K is of little value to the b in the absence of these salts, which are necess for its proper absorption.

23. Melton, G.: Oxygen Therapy in Shock, Lancet **1**:481 (April 17) 1943.

24. Figi, F. A.; New, G. B., and Dix, C. R.: Radiodermatitis of the Head and Neck, with a Discussion of Its Surgical Treatment, Surg., Gynec. & Obst. **77**: 284 (Sept.) 1943.

25. Sutton, L. E.: Plastic Surgery in the Treatm of War Casualties, Am. J. Surg. **61**:239 (Aug.) 1

26. Vitamin Deficiency by Interference, editorial A. M. A. **123**:151 (Sept. 18) 1943.

Other examples of such "secondary vitamin ficiencies" include avitaminoses observed in imals fed a diet of raw fish, which destroys B_1 vitamin, causing death from thiamine iciency although the diet contains an ade- te amount of the vitamin. When the fish is ked, the antagonistic substance is destroyed, l the animals do not show thiamine deficienc-

GRAFTING OF SKIN

Sachs and Goldberg[27] report the successful of infants' foreskins as isogenous grafts for ering a variety of surface defects. Some of foreskins were used soon after removal, while ers were placed in sterile isotonic solution of ium chloride and kept in the refrigerator for w days before being applied to the recipient Isogenous shaved grafts, the skin being oved from premature infant cadavers, were used to cover raw areas in burned patients. authors report from 65 to 75 per cent suc- ful "takes" and claim that some grafts could distinctly recognized eight months after trans- In 1 of the cases followed up during a od of more than two years the patient had no loss of grafted skin with the exception wo small areas. In the authors' experience blood group relationship between donor and pient did not influence the survival of the fts.

Comment: All carefully written articles on genous skin grafts are welcome contribu- s since they may add to the meager store nowledge on the subject and eventually aid e investigator to transfer skin from one per- to another that will remain as a permanent ering. Thus far, with the exception of cases hich the transfer was made in identical twins, e are no accredited reports of successful graft- of isogenous skin with either infant or adult The grafts frequently "take" for a short but invariably disappear after a few weeks. this basis isogenous skin grafts have been cated by some surgeons as a temporary cov- g for severe burns.

he available evidence indicates that the isog- us foreskin grafts identified by Sachs and dberg on the recipient sites eight months after sfer were actually islands of the patient's skin which had replaced the foreign skin fts. Intradermal injection of the foreskin fts by india ink before transfer would have lled the authors to distinguish between the fted isogenous skin and proliferating islands he patient's skin.

27. Sachs, A. E., and Goldberg, S. L.: Foreskin rafts, Am. J. Surg. **60**:255 (May) 1943.

Most experienced surgeons believe that there is sufficient uninjured skin left on all surviving patients with burns to provide small deep grafts for the burned area. The grafts may be removed and applied under local anesthesia at the bedside with little shock to the patient. These small autogenous grafts will cover wide defects and remain as a permanent cutaneous surface for the burned area.

While assisting at skin grafting operations, Sano[28] noted that considerable difficulty was encountered because of bleeding beneath the graft. The thought occurred to her that the skin graft might be made to adhere to its bed through the use of plasma, thus obviating the necessity for a pressure dressing over the graft. She applied the method successfully in rats and later in human patients.

The technic used for the grafts of human skin is as follows: Into a 10 cc. syringe containing heparin and Tyrode's solution, 5 cc. of the

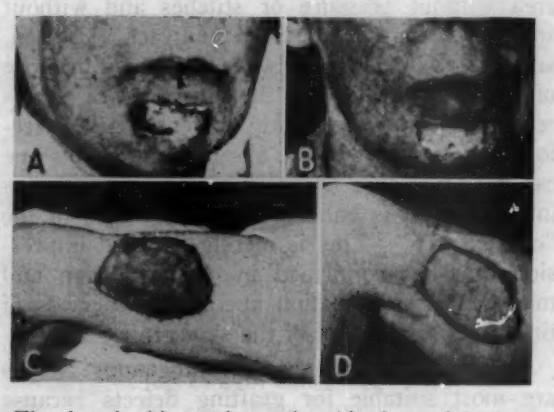


Fig. 1.—*A*, skin graft on the chin forty-eight hours after grafting by the Sano method. *B*, same skin graft five days after grafting. *C*, skin graft on the thigh forty-eight hours after grafting by the Sano method. *D*, same skin graft three weeks after grafting. (After Sano.[28])

patient's blood is drawn. The blood is centrifuged and the plasma transferred to a small test tube. Tyrode's solution is then added to the remaining red and white cells, and the cell mixture is agitated and then centrifuged to obtain the supernatant fluid or cell extract. The under surface of the skin graft is moistened lightly with this cell extract, and the plasma is applied to the raw area. The graft is then quickly fitted into the raw area, and a single strip of boric acid gauze is placed over the graft to protect it from infection and drying. No pressure is applied over the graft, and no stitches are used.

28. Sano, M. E.: Skin Grafting: A New Method Based on the Principles of Tissue Culture, Am. J. Surg. **61**:105 (July) 1943.

Sano states that the application of plasma to the raw area has a tendency to stop the oozing and that the growth of blood vessels into the graft is made more rapid by application of the cell extract.

(Comment: It is common knowledge that skin grafts will take on raw areas when bleeding is controlled and the graft simply applied to the surface. For many years pinch grafts were employed in this way and successful takes were obtained.

About fifteen years ago Ferris Smith demonstrated that within certain limits pressure applied over the graft increased the percentage of successful takes. His observations have been confirmed by numerous investigators, and the principle of the pressure dressing has been adopted by Allen and Koch in the treatment of burns.

Sano's method is interesting, but controls are lacking. Plastic surgeons already know that skin grafts will take when simply applied to the raw area without pressure or stitches and without application of plasma and "cell extract." Indeed, any raw recipient area always contains a mixture of plasma and cells, and the equivalent of Sano's cell extract is consequently present. It is therefore doubtful that in the absence of controls one can conclude that the growing of blood vessels into the graft is enhanced by application of the "cell extract." This is merely a visual impression and not confirmed by tissue section and microscopic examination at various intervals of time after application of the skin graft.)

According to Sheehan,[29] autogenous tissues are most suitable for grafting defects because such tissues are living entities. He advises a complete check-up of the patient's general condition including a blood platelet count preoperatively and a postponement of operation if this preliminary examination is not satisfactory.

The presence of infection in the granulating area or of pimples in the operative field contraindicates operation until the condition is corrected. In grafting of skin on the face attention should be paid to the color and the texture of the transplant, which must match the surrounding facial skin. Transfers of skin to the face are to be avoided when it is possible to repair the defect by utilizing the adjacent skin through advancement or the Z flap procedure.

Cartilage is an excellent material to use beneath the skin to support it in a fixed relationship, and following transplantation autogenous cartilage remains as a living entity, which does not deteriorate. Bone grafts should be transplanted in contact with bone; otherwise absorption and di integration will occur.

Other serviceable grafting materials are derm grafts, fat, fascia, nerve and tendon. Sheeha states, however, that human tissues do not tolera foreign bodies and disappointment meets t tentative hope that gold, silver, ivory or a other foreign substance will be exceptional.

Kirkham[30] advises early grafting of skin a third degree burned area as soon as the wou is clean and healthy. It is important to use goo judgment concerning which areas should recei a graft first, and this is particularly true in t presence of extensive burns with many are involved. The best rule to follow is to gra skin first in those areas where the greatest amou of functional incapacity will result; later the co metic side of reconstruction may be considere

When grafting on the face one should choo skin which matches the adjacent uninjured faci skin in color, texture and presence or absen of hair. In general, Kirkham advises the sp graft as the best type of covering.

In patients with inherent tendencies towa keloid formation he recommends the procedu used by Sir Harold Gillies and Dr. Levitt. Th procedure consists of screening all but the actu line of contemplated incision, which has be accurately marked with methylene blue; the inc sion line is then subjected to an erythema do of roentgen rays, the dosage used on the fa being 10 per cent lower than elsewhere. T operative excision is performed during the peri of active erythema, usually in five to ten da and a second erythema dose is given over t scar on removal of the sutures, as a rule fo days postoperatively.

Kazanjian[31] warns that premature grafting skin to facial lesions which are infected is doom to failure. Before a skin graft is applied, t granulating surface should be shaved with a sha razor knife and all bleeding controlled to preve collection of blood beneath the graft.

In the management of facial injuries he stress the importance of preserving vital tissue and loo fragments of bone, which are generally adhe ent and which possess vitality and regenerati power. In many cases there is little justificati for operation immediately after the admission the patient to the base hospital.

According to Evans,[32] the most importa single factor in the prevention of infection

29. Sheehan, J. E.: Tissue Grafting, Am. J. Surg. **61**:339 (Sept.) 1943.

30. Kirkham, H. L. D.: Plastic Procedures in Bur Bull. Am. Coll. Surgeons **28**:144 (June) 1943.

31. Kazanjian, V. H.: Plastic Surgery, Bull. A Coll. Surgeons **28**:140 (June) 1943.

32. Evans, E. I.: The Early Repair of Skin Defe Caused by Severe Burns and Wounds, Bull. Am. C Surgeons **28**:142 (June) 1943.

ned areas is the masking of all persons who e in contact with the patients when the burned s are uncovered.

Regardless of how clean the granulating surface ears, grafting should not be attempted ss the protein level of the blood is above 5.8 cent and the hemoglobin above 75 per cent. se requirements often necessitate frequent e transfusions of whole blood.

Evans believes that pinch grafts are extremely uable in covering extensive burned areas, ecially in children. The best results, how- , are obtained by grafts of intermediate thick- removed by the Padget dermatome.

(Comment: Irrespective of the mechanical of the operator, skin grafts will not take atients whose plasma protein is low or whose oglobin is excessively low. It is always ad- ble for the surgeon to determine the general dition of his patient before applying skin fts.)

Douglas and Buchholz [33] describe a new hod for determining the systolic blood pres- and the return of temperature in double and le pedicle tube flaps of skin and subcutaneous ue.

Applying the Brooks thermocouple apparatus, y developed a test called the temperature rn test for determining the efficiency of cir- tion in tubed flaps. In dogs this test indi- d increasing circulatory efficiency from the e of the formation of the flap until the sixth eventh day, at which time the circulation ugh either pedicle to the other end appears ach almost maximum efficiency. The pedicle be safely transferred at this time.

Evidence accumulated from a number of human s seems to indicate the advantages of this iologic test in individualizing the circulation e flap in order to save time with safety be- n stages and to avoid unnecessary delays.

Cannaday [34] reviews the history of the dermal t (cutis graft) in surgery and states that this , while used to a considerable extent in pe, has not received much attention from al surgeons in the United States.

he graft is obtained from the patient's thigh, epidermis being cut away in a thin sheet with or, after which a layer of the exposed derma utlined and removed from its bed. A layer ubcutaneous fat may or may not be left on nder surface of the graft.

Cannaday quotes clinical and experimental work which demonstrates that the buried dermal graft is well tolerated by the host tissues, does not cause cyst formation and is gradually converted into fibrous tissue. The dermal graft may be used to fill depressions about the head and face, for the replacement of damaged tendons and for various other conditions where fascia might be employed.

(Comment: The dermal graft may serve the purpose of filling shallow depressions of the nose, retracted eye sockets or depressions in the region of the cheek and neck. Depressions involving displacement or loss of bone, such as depressions in the skull, in the brow or in the malar region, are best repaired with cartilage or bone grafts. In general, the dermal graft is a satisfactory filling substance for soft tissue defects but is not usually indicated to replace a lost bone structure.)

Mock [35] reports the use of refrigeration anesthesia for donor sites from which skin grafts are to be removed. Two hours before the operation one or more uncovered ice bags are applied directly to the area from which the skin is to be taken. Slight pressure deepens the effect of the anesthesia. It has been the author's practice to tie or bandage the ice bags in place. The maximum anesthetic effect lasts about twenty minutes after the ice bags have been removed. Skin grafts are shaved from the chilled area in the usual manner without pain to the patient. Refrigeration does not affect the growth of the graft or the repair of the donor site.

Marcks [36] describes a modified, calibrated knife for grafting of skin consisting of an attachment fitted on the Blair-Brown knife. The apparatus is calibrated in units and when properly adjusted will cut a graft of equal thickness throughout.

NOSE

Aufricht [37] describes a new method for narrowing the bony dorsum of the nose after removal of a large hump. The bony connection at the radix is divided, and the bony web from within the dorsum is removed as well as a corresponding segment from the radix when necessary. By removal of the web from between the nasal bones, the bony sides of the nose will come together without leaving the wide dorsum which was formerly a problem.

He also describes a surgical procedure for shaping the ala by excising a variety of geomet-

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Douglas, B., and Buchholz, R. R.: The Blood ation in Pedicle Flaps, Ann. Surg. **117**:692 (May)

Cannaday, J. E.: Some of the Uses of the Cutis in Surgery, Am. J. Surg. **59**:409 (Feb.) 1943.

35. Mock, H. E., Jr.: Refrigeration Anesthesia in Skin Grafting, J. A. M. A. **122**:597 (June 26) 1943.

36. Marcks, K. M.: A Modified Calibrated Skin Grafting Knife, Mil. Surgeon **92**:653 (June) 1943.

37. Aufricht, G.: A Few Hints and Surgical Details in Rhinoplasty, Laryngoscope **53**:317 (May) 1943.

ric forms from the floor of the nostril. For cases with an absence of the nasolabial angle, a method of subcutaneous suturing is described which restores the angle and avoids scar formation at the base of the columella.

(Comment: This is an important article for all surgeons who are interested in refinement of nasal plastic technic.)

Salinger [38] advises early correction of nasal injuries regardless of the initial edema. There are, of course, cases of massive injuries and shock in which it is inadvisable to do anything except control the hemorrhage and institute local antisepsis. Yet if sutures are carefully inserted and lost tissue replaced within twelve to twenty-four hours, one may duplicate the good results seen in patients who received earlier care.

He cautions generally against performing submucous resection of the nasal septum in patients who are younger than 16 or 17 years. Children with displacement of the lower border of the septal cartilage may be relieved of their obstruction by replacing the dislocated cartilage in the

Fig. 2.—*A*, "outfracturing" technic. The chisel is shown in situ cutting through the bony web of the nasal bridge and the radix nasi after the hump has been resected. The dotted lines indicate the segment to be removed from the bony web and the radix nasi. *B*, bony side of nose "outfractured" with the chisel. (After Aufricht.[37])

proper position. This procedure does not interfere with later growth of the nose.

Seltzer [39] describes the anatomy of the nose from the point of view of surgery and gives a detailed account of the preoperative management for nasal plastic operations. He also presents a technic for narrowing the bony bridge, which consists of detaching the lateral cartilages from the septal cartilage and separating the nasal bones from the septum by means of a chisel. The base of the nasal arch on each side having been previously separated from the maxilla by a saw, the nasal arch is now fractured outward by outward pressure with the chisel.

Womack [40] gives a description of a device the treatment of fractures of the nose, whic designed primarily to keep the bony fragm in alinement but can be used also to set adjust the fragments. The contrivance is c fortable to wear and does not interfere eating or with vision, and the results obtai from its use have been excellent.

The use of a modeled nose on a mask an rhinometer prior to undertaking plastic pr dures on a living nose is recommended by B son.[41] He states that exact measurement each stage of a nasal plastic operation are portant as a guide to the best surgical tech The mask and measurements employed are ba on a careful study of the nose of the indivi patient.

In Becker's [42] opinion, various deformities the external nose may be sufficient to divert currents or to cause collapse of the alae depression of the liminal vestibule. The m important deformities from this point of v are the long nose, the redundant nasal tip, twisted nasal tip, the depressed nose and formed nasal cartilages. Correction of any these nasal deformities is indicated chiefly improve the nasal function, but it also impro the patient's appearance.

Luongo [43] makes the statement that rhi ogists have not given enough thought to value of rhinoplasty as a part of their necess training. This is unfortunate inasmuch as m patients with nasal disorders cannot be c pletely relieved without supplemental surg treatment for the external deformity of the n

Gillies [44] discusses the methods in use lining the under surface of forehead flaps wh are used to form the nostril margins in lo about the nasal tip:

1. When flaps have been turned in from neighborhood to form the lining of the nos trophic conditions are apt to develop in th and marginal necrosis may occur where stitches have been placed.

38. Salinger, S.: Posttraumatic Rhinoplasty: Secondary Correction of Deformities Involving the Septum and External Nose, Ann. Otol., Rhin. & Laryng. **52**:531 (June) 1943.

39. Seltzer, A. P.: An Improved Method of Narrowing the Nose, Ann. Otol., Rhin. & Laryng. **52**:460 (June) 1943.

40. Womack, D. R.: A Fracture Device for Nose, U. S. Nav. M. Bull. **41**:852 (May) 1943.

41. Berson, M. I.: Prevention of Deformities Corrective Rhinoplasty, Laryngoscope **53**:276 (A 1943.

42. Becker, O. J.: Nasal Deformity in Relatio Respiratory Function, Eye, Ear, Nose & Th Monthly **22**:133 (April) 1943.

43. Luongo, R. A.: Rôle of Rhinoplasty in Rest tion of Nasal Function, Arch. Otolaryng. **37**:749 (M 1943.

44. Gillies, H.: A New Free Graft Applied to Reconstruction of the Nostril, Brit. J. Surg. **30** (April) 1943.

2. The placing of a free skin graft under the rtion of the forehead flap which is designed make the nostril margin is fairly satisfactory, t the new nostril is liable to be lacking in sup- rt and is apt to contract and form an atretic stril.

3. An extra piece of the covering flap may be rned in so that the margin is formed by a uble portion of the external flap. This also is cking in support, may become necrotic and rms a rather thickened margin.

Gillies describes a new technic in which he moves a section of skin and cartilage from e anterior conchal region of the ear and applies under the distal end of an outlined forehead p. The flap with the supporting curved car-

to provide both a lining and a support for the soft parts of the nose. In the second stage a flap from the left side of the forehead was used to provide the outer cover and give the correct shape to the nose.

Davis [46] is of the opinion that incipient and early basal cell growth can frequently be destroyed by application of caustics, fulguration, desiccation, or treatment with radium or roentgen rays. To be safe the destruction must be complete.

The defects resulting from the use of some of these methods, however, are apt to leave more scarring than does a clean excision. In cases of early growth and in those of recurrence in which the involvement is not so extensive as to make

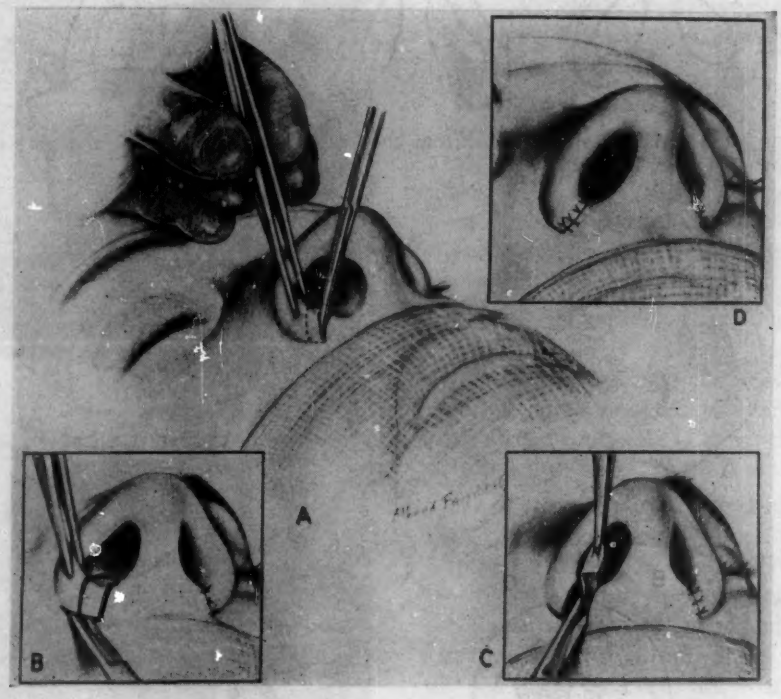

Fig. 3.—*A*, *B* and *C*, excision from the lower border of the right nostril. *D*, reconstructed base of the nostril vestibulum. (After Aufricht.[37])

ge and skin lining is then swung down in the al manner to form the nostril. The author es that the new nostril is delicate in shape does not tend to collapse, because of its sup- ting cartilage framework.

According to Tauber-Hradsky,[45] nasal mutila- n is common in India, but as a rule only the t tissues are destroyed, the bony nasal bridge ely being injured. During his stay in India developed a new method in rhinoplasty, per- med in two stages. In the first stage a flap m the right side of the forehead was used

complete excision inadvisable, Davis prefers excision with the cold knife and such plastic repair as is adaptable to the situation.

According to Weaver,[47] basal cell epithelioma is usually slow growing and does not metastasize; therefore, its early treatment by adequate surgical measures gives good results. Equally favorable results have been reported following irradiation. Because of inadequate treatment in some cases the epithelioma continues to progress and to

5. Tauber-Hradsky, H. T.: Nasal Mutilation in a and a New Rhinoplasty, J. Internat. Coll. Surs **6**:27 (Jan.-Feb.) 1943.

46. Davis, W. B.: Basal Cell Lesions of the Nose and Lip: Relation to Roentgen Treatment and Plastic Surgery, Arch. Otolaryng. **37**:748 (May) 1943.

47. Weaver, D. F.: Free Skin Grafts and Pedicled Flaps in the Treatment of Recurring Basal Cell Epitheliomas, Laryngoscope **53**:336 (May) 1943.

involve the underlying cartilage and bone of the nose, so that wide removal by excision or diathermy becomes necessary. With the use of a free skin graft or a pedicled flap a satisfactory cosmetic result can generally be obtained.

ized under four procedures, enumerated in order of their importance, the first two being life saving and the second two influencing time of treatment and the quality of the results:

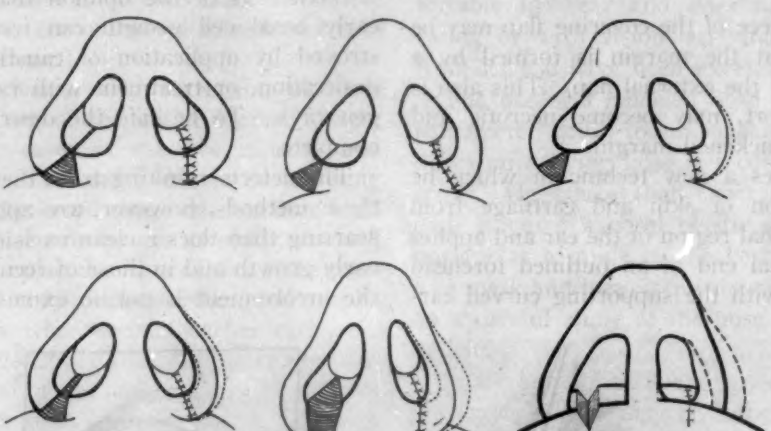

Fig. 4.—Diagrams of a few typical excisions from the base of the right nostril and ala; the effect is indicated on the left nostril. (After Aufricht.[37])

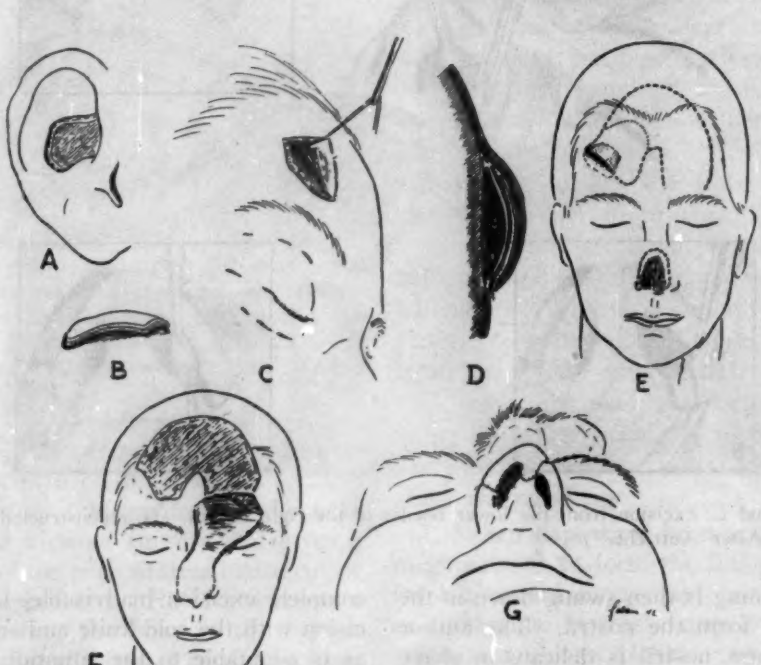

Fig. 5.—*A*, donor area of the ear from which skin is removed for grafting. *B*, the chondrocutaneous gr *C*, the graft implanted into the forehead—an ordinary skin graft is also applied to the area from which the f has been raised. *D*, diagram of pressure dressing. *E* up and down forehead flap. *F*, pedicle in place. completion. (After Sir Harold Gillies.[44])

FACE, SKULL AND JAWS

From his experiences in World War I, Blair [48] draws conclusions concerning the early care of major facial wounds. This care can be summar-

1. Establish a free airway. Control bleedi and shock.

2. Do not make tight closure of wounds with the floor of the mouth or the lower buccolab sulci without simple provision for adequa drainage.

48. Blair, V. P.: Relation of the Early Care to the Final Outcome of Major Face Wounds in War Surgery, Mil. Surgeon **92**:12 (Jan.) 1943.

3. Restore all displaced fragments or masses of the face bones and fix them in proper position as early as is practical; if not immediately, preferably within the first two or three weeks.

4. Do not remove any attached bone or possibly viable soft tissue from the face.

Ivy [49] reviews the advances made in the field of oral and plastic surgery during the past thirty-five years. He states that, while great progress has been made, there is still room for improvement in many directions. Among the important advances he lists the modern treatment of shock and hemorrhage, specific treatment for syphilis,

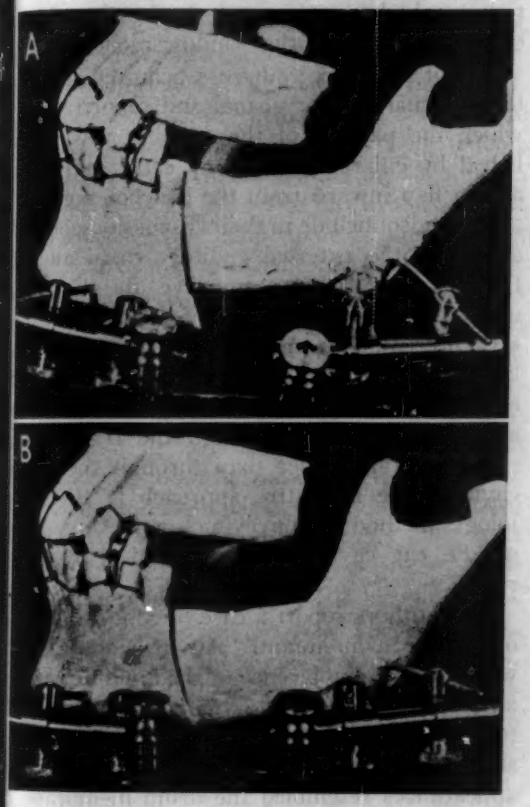

Fig. 6.—*A*, Waldron's apparatus assembled in a case of mandibular fracture with a long edentulous posterior fragment before reduction. *B*, same case after reduction of the fracture. (After Ivy.[49])

modern methods for inducing local and general anesthesia, the development of the use of the Roentgen ray for diagnosis, the newer treatment of fractures of the jaws and the improved technic for the correction of harelip and cleft palate.

In Cannon's [50] opinion the forehead flap is useful in replacing tissue lost from the nose, cheek or lips. It is the most readily available and can be transferred with minimum discomfort and disability. A flap from the inner surface of the arm is generally suitable for repairs about the face. The skin in this area of the arm has a delicate texture, but it may be whiter than the facial skin and it may have a fine growth of hair.

MacFee [51] describes a method for repairing full thickness defects of the cheek and lips by utilizing a sliding skin and mucous membrane flap from the adjacent cheek region.

In a discussion of emergency plastic surgery for war injuries of the face, Converse [52] warns of the danger in patients with cerebrospinal rhinorrhea due to fracture through the cribriform plate. Fracture of the orbital floor with displacement downward, if uncorrected, will result in permanent double vision.

Lambros [53] reports that a large defect of the skull was successfully repaired by means of an autogenous bone graft removed from the patient's ilium. He states that the cosmetic results obtained in cranial defects with ilium grafts are superior to those obtained with bone grafts from the ribs or the tibias.

Pudenz [54] implanted tantalum plates in the cranial defects of 11 cats; later he killed the animals and examined the areas to ascertain the results. From these experimental studies he concludes that tantalum is a satisfactory alloplastic material for the repair of cranial defects.

In a case reported by Fulcher [55] a cranial defect was repaired by the use of a tantalum implant. When he observed the patient about two months after operation, he found a completely satisfactory cosmetic and functional result. He thinks that vitallium plates may also be used for the same purpose, but that vitallium, which is an alloy, must be cast, for it will not lend itself to hammering, nor can it be cut or bent. Tantalum, which is element 73 in the periodic table, can be obtained in plates or sheets of any desired size. It is inert, can be bent or hammered, and can be sterilized by boiling.

49. Ivy, R. H.: Surgery of the Face, Mouth and Jaws, Thirty Years Ago and Now, J. Oral Surg. **1**:95 (April) 1943.

50. Cannon, B.: The Use of Remote Flaps in Repair of Defects of the Face and Mouth, Am. J. Orthodontics (Oral Surg. Sect.) **29**:77 (Feb.) 1943.

51. MacFee, W. F.: Full Thickness Defect of the Cheek Involving the Angle of the Mouth, Surg., Gynec. & Obst. **76**:100 (Jan.) 1943.

52. Converse, J. M.: Some Aspects of Emergency Plastic Surgery in War Injuries of the Face, Ann. Otol., Rhin. & Laryng. **52**:637 (Sept.) 1943.

53. Lambros, V. S.: Repair of Large Cranial Defects, Arch. Surg. **46**:575 (April) 1943.

54. Pudenz, R. H.: The Repair of Cranial Defects with Tantalum, J. A. M. A. **121**:478 (Feb. 13) 1943.

55. Fulcher, O. H.: Tantalum as a Metallic Implant to Repair Cranial Defects, J. A. M. A. **121**:931 (March 20) 1943.

Peer [56] describes a new method for repairing deep depressions of the skull by means of "diced cartilage grafts." Segments of rib cartilage are removed from the right side of the patient's chest and cut into many fine cubes in the same manner as a cook dices carrots when preparing them for a salad. The mass of diced cartilage grafts is then introduced into an exposed depression in the skull, the cartilage cubes are gently patted to take a rounded contour and the skin of the scalp is then sutured over the rounded surface of the cartilage mass.

Experimental studies showed that the spaces between the small cartilage cubes were occupied first by blood and later by ingrowing blood vessels and connective tissue, which bound the grafts firmly together in the form of a solid plaque.

The author repaired the skulls of 8 patients with diced cartilage grafts and noted that the postoperative contour of the forehead in each instance was far superior to that previously obtained with large segments of rib cartilage.

When preserved cadaver cartilage or living cartilage taken from a relative is used, the cartilage may be diced before the operation, thus shortening the period of anesthesia.

Diced cartilage grafts may also be used to form the framework of an ear in total reconstruction of an auricle and to fill depressions over the malar bone. Cadaver cartilage grafts are an ideal filling substance for depressions in the mastoid process resulting from simple mastoidectomy.

Kelemen [57] gives an interesting description of the gross and microscopic observations in the temporal bone of a 10 year old child with congenital meatal atresia. The eustachian tube was patent, and a tympanic cavity was present which was lined with epithelium. The stapes appeared normal but the incus and the malleus were replaced by a single fused bone. The round window was closed by solid fibrous tissue, and the oval window, occluded by bony fixation of the footplate of the stapes. The external auditory canal was present as a partly canalized epithelium-lined tube extending outward from an occluding plate of bone in the region of the drum membrane. The external ear was absent except for a misshapen mound of skin-covered cartilage. Associated with the deformities of the external and middle ear there was incomplete development of some structures of the inner ear. Kelemen concludes that the formation of a skin-lined t from the outside to the middle ear cavity wo not have improved the hearing in this partic case.

(Comment: This is a most instructive re and should be read by all surgeons contempla operation on patients with meatal atresia to i prove their hearing. Retarded development the inner ear is not frequently associated w developmental anomalies of the middle and ex nal ear. As a rule, patients with meatal atre have a normal labyrinth on the affected side.

In Kelemen's case it seems doubtful that e though the labyrinth had been normal an ope tion would have improved the hearing, beca of the occlusion of the window niches.)

Cohen and Fox [58] discuss acquired atresia the external auditory canal and report a case which the patency of the opening was reest lished by enlarging the bony canal and turn a skin flap inward from the conchal region.

They also include in their discussion congen atresia of the external auditory canal and st that an operation to improve the hearing usually indicated only in bilateral cases. Nec sary prerequisites are the presence of a nor labyrinth and roentgenographic evidence of existence of a middle ear cavity. The operat approach should be through the region of external canal rather than through the mast cavity, since the latter approach is an unph iologic method of conveying sound waves to middle ear cavity and is attended by grea risk.

The authors report a case of congenital atre occurring in an infant. An incision was ma within the circumference of the annular ring, a all soft tissues were dissected and removed do to the depth of the tympanic membrane. Her structure was uncovered which in all outwa appearances resembled the drum membrane. mold of dental compound was inserted, and wit one month the new external canal was co pletely epithelized. No later report on the he ing was obtained.

(Comment: In the opinion of the review an operative approach through the region of external canal in the hope of exposing a norm drum membrane is a useless procedure. In single case described by Cohen and Fox in wh this approach was used, the patient had no po operative hearing tests and the result therefo is not convincing.

The approach through the mastoid cavity, tablishing a skin-lined opening into the mid

56. Peer, L. A.: Diced Cartilage Grafts: A New Method for Repair of Skull Defects, Mastoid Fistula and Other Deformities, Arch. Otolaryng. **38**:156 (Aug.) 1943.

57. Kelemen, G.: Malformation Involving External, Middle and Internal Ear with Otosclerosis Focus, Arch. Otolaryng. **37**:183 (Feb.) 1943.

58. Cohen, L., and Fox, S. L.: Atresia of the Ext nal Auditory Canal, Arch. Otolaryng. **38**:338 (O 1943.

cavity, as described by Colver is a safer procedure since it enables the surgeon to identify structures under direct vision.

The procedure advocated by Cohen and Fox acquired meatal atresia appears logical. In such cases, a normal drum membrane and a normal bony canal are both present, and removal of the obstructive scar restores the hearing. In congenital meatal atresia, however, a normal drum membrane is probably never present, and a normal bony canal is seldom seen.)

In a rare case of pulsating cavernous hemangioma of the external ear reported by Weaver,[59] the growth was successfully removed without destroying the structure of the auricle. The pulsating growth involved all of the anterior surface of the auricle except the lobule but apparently did not extend through the cartilage to the posterior surface. Weaver first ligated the large arteries and veins supplying the the auricle, after which most of the pulsations in the vascular growth ceased. He then made a long incision through the skin close to the helix, elevated the skin and removed the growth from the underlying cartilage. The skin flaps were resutured in place, and a pressure dressing was applied. The ear was quite normal in size and appearance three weeks after the operation. (Comment: Pulsating arterial angioma differs from the ordinary benign types of angioma in that it tends to establish connections with normal blood vessels in the vicinity. It is a dangerous kind of growth, as it may extend widely, eroding the skull and penetrating the brain.)

Griffin [60] reviews the various operative procedures advocated for the correction of retroauricular fistula and suggests that the number of these procedures testify to the fact that no one has yet met with complete success. He describes his own technic, which consists of excision of all scar tissue and overlying epithelium down to bone in the region of the fistula. Diseased bone, if present, is removed and a fan-shaped flap of temporal muscle is turned down to fill the depressed area. A scalp flap formed along the posterior margin of the wound is then brought forward in the usual manner and sutured to cover the temporal muscle.

Berson [61] reports a modification of the method for reconstructing an auricle in which the operative procedures are reduced to two stages. His technic consists of carving a segment of the patient's rib cartilage in the shape of a normal ear and inserting this framework into a subcutaneous pocket in the region where the new ear is to be formed. Four weeks later a semilunar incision is made through the skin, at a distance of 1.5 cm. from the rim of the cartilage graft. The deep surface of the cartilage is then elevated, and the excess of skin at the rim is curled and sutured on itself to form the helix and lobule. The deep surface of the cartilage and the adjacent cranium are covered by a split graft wrapped around a dental stent mold.

Dorrance and Bransfield [62] emphasize the value of the "push-back" operation originated by Dorrance in 1925 to provide more adequate velopharyngeal closure in patients with short palates. They report two modifications of this operation, both of which during the past five years have given satisfactory results. The first is the use of the mucoperiosteum of the vomer to close the cleft in the hard palate, a single flap being employed when the septal base is attached to one of the palatal shelves, or two vomer mucoperiosteal flaps when the septal base is free in the midline. A later push back operation is performed by elevating and detaching the two mucoperiosteal flaps that cover the bony palatal shelves, displacing them backward and suturing them together in the midline. The soft palate cleft is sutured in the usual manner, and the cleft in the bony palate remains closed by the undisturbed vomer flap.

The second modification of the push back procedure is the lining of the palatal mucoperiosteal flap with a Thiersch or a split skin graft at one operation and the later displacing of the skin-lined flap backward as in the original push back operation.

Dorrance and Bransfield believe that less anterior contracture of the palate occurs postoperatively when the nasal surface of the flap is covered by the skin graft.

The procedures are clearly illustrated by drawings.

(Comment: The two modifications presented in this article represent refinements of the Dorrance push back operation, which is a valuable procedure for lengthening a short palate.)

Straith and Patton [63] report that 6 of 13 members in three generations of a family had bilateral mucous cysts in the lower lip associated with harelip and cleft palate deformities. The

59. Weaver, D. F.: Three Unusual Cases of Hemangioma, Ann. Otol., Rhin. & Laryng. **52**:507 (June) 1943.

60. Griffin, E. A.: Treatment of Retroauricular Fistula, Arch. Otolaryng. **37**:802 (June) 1943.

61. Berson, M. I.: Complete Reconstruction of Auricle, Am. J. Surg. **60**:101 (April) 1943.

62. Dorrance, G. M., and Bransfield, J. W.: Cleft Palate, Ann. Surg. **117**:1 (Jan.) 1943.

63. Straith, C. L., and Patton, H. S.: Bilateral Congenital Mucous Cysts in Three Generations, J. A. M. A. **123**:693 (Nov. 13) 1943.

authors believe that the genetic factor responsible for the presence of these glands is as dominant as is the harelip factor. Simple excision is the treatment of choice.

According to Mansie,[64] bilateral harelip and cleft palate frequently result in a particular deformity, the upper lip being short and tightly pressed against a deficient and underdeveloped maxilla. The lower lip is full, and the condition is often aggravated by a protruding lower jaw, which brings the lower lip farther forward. To repair this condition the author advises the insertion of an epithelial graft to deepen the sulcus between the lip and the upper jaw. A prosthesis is placed in this space to give greater fulness to the upper lip. (Comment: One suspects that the recession of the upper lip in many of these patients was due to poor operative technic in the repair of the harelip. Surgeons often set the protruding middle segment of the lip t far backward, which gives rise to later recessi of the upper lip.)

For facial restorations with synthetic su stances Matthews[65] prefers rubber latex. T problem in this type of work is the suitabil of various materials to the needs of the particul patient. While both metal and gelatin-glyce mixtures are still used, recent progress is co cerned with the use of acrylic resins for rig restorations and rubber latex for nonrigid res rations.

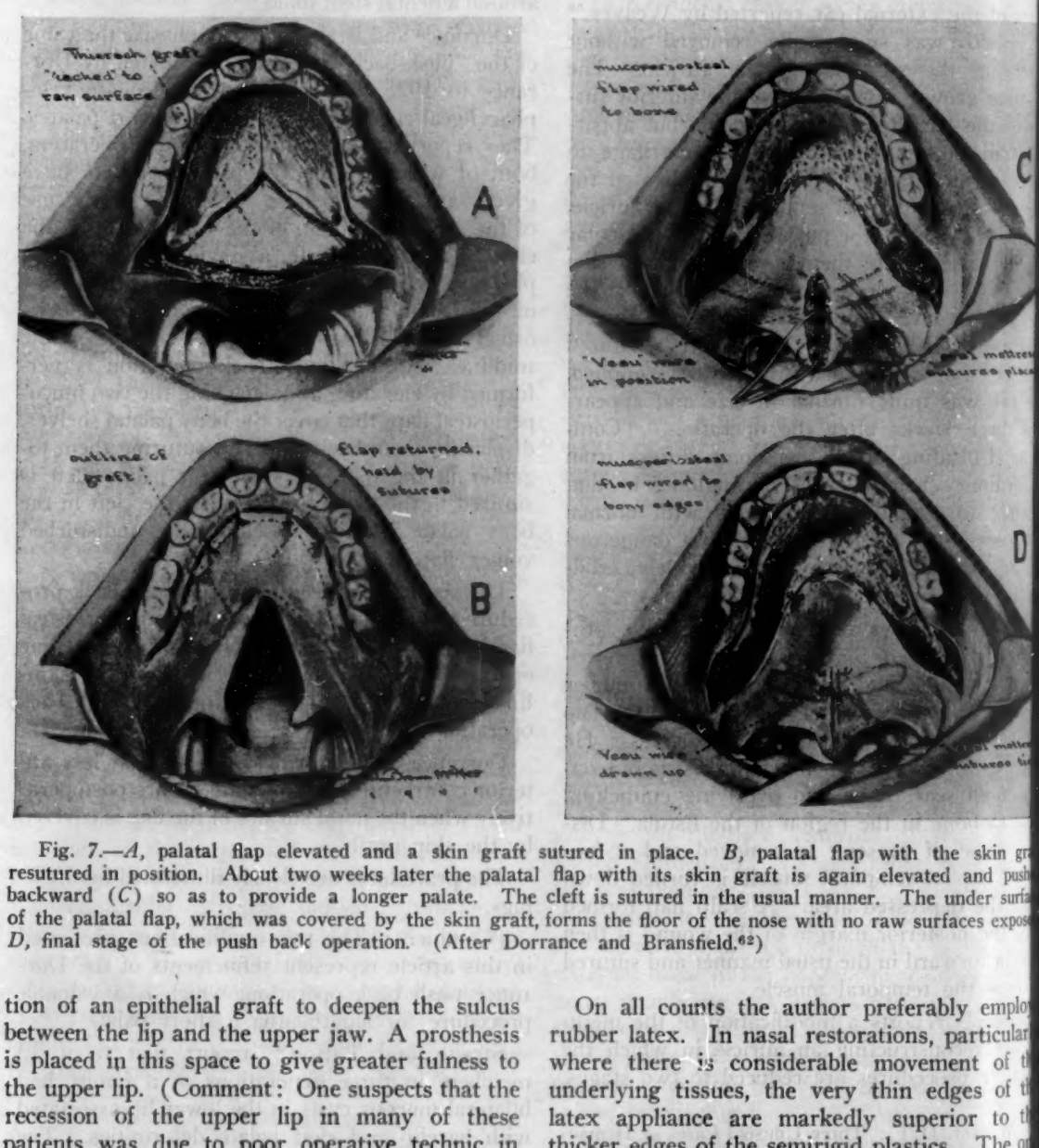

Fig. 7.—*A*, palatal flap elevated and a skin graft sutured in place. *B*, palatal flap with the skin gr resutured in position. About two weeks later the palatal flap with its skin graft is again elevated and push backward (*C*) so as to provide a longer palate. The cleft is sutured in the usual manner. The under surfa of the palatal flap, which was covered by the skin graft, forms the floor of the nose with no raw surfaces expos *D*, final stage of the push back operation. (After Dorrance and Bransfield.[62])

On all counts the author preferably emplo rubber latex. In nasal restorations, particular where there is considerable movement of t underlying tissues, the very thin edges of t latex appliance are markedly superior to t thicker edges of the semirigid plastics. The ou real limitation of the use of rubber latex is t tendency to "age," which manifests itself

64. Mansie, J. W.: Intra-Oral Prosthesis in Bilateral Harelip and Cleft Palate, Proc. Roy. Soc. Med. **36**: 483 (July) 1943.

65. Matthews, E.: Facial Restorations, Proc. Ro Soc. Med. **36**:484 (July) 1943.

me loss of elasticity and a slight change in lor.

The various forms of apparatus employed in eletal fixation for fractures of the mandible e discussed by Ivy and Curtis.[66] The basic inciple of all types of apparatus utilizing pins the bone with external bar fixation was for-ulated by Parkhill in 1897. Ivy and Curtis lieve that the only indication for using this ethod on the mandible is for the control of agments when teeth are absent or do not ford attachment for intraoral appliances. It ould not replace the regular methods of intra-al fixation when teeth are available. Excellent otographs demonstrating the technic for insert-g pins in the bone fragments are included in e article.

Waldron,[67] with the collaboration of Kazan-n and Parker, reviews the various methods

"Open bite" is described by Thoma[69] as a condition in which there is a space between the anterior teeth of the upper jaw when the posterior teeth are in contact. Those having this deformity are unable to bite off food, such as a piece of apple. Some are mouth breathers, not being able to keep their lips closed, and they are therefore liable to suffer from chronic pharyngitis, tonsillitis and adenoids.

The deformity of "open bite" may be due to malformation or to improper reduction of a fracture of the maxilla or the mandible. Thoma describes a method for its correction by excising a Y-shaped segment of bone from the horizontal ramus of the mandible.

In the opinion of Coakley and White[70] the correction of an acute fracture displacement of the malar bone is as a rule a simple procedure, while the late correction of this deformity, once

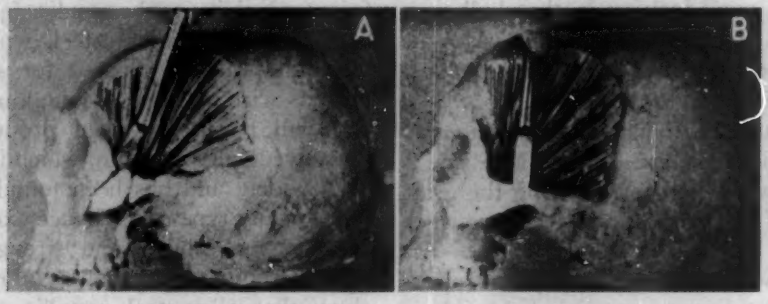

Fig. 8.—*A*, diagram of the temporal approach to reduce a fracture of the arch. *B*, replacement of the arch rough the temporal approach. (After Coakley and White.[70])

ed for skeletal fixation in the treatment of actures of the mandible. They conclude that esent methods of skeletal fixation as used by number of surgeons are logical refinements of er methods and that these technics will change ll more until they assume a definite and per-nent place in the treatment of fractures of e mandible. Excellent illustrations accompany e article.

According to Converse,[68] the converging pin thod of external skeletal fixation devised by ger Anderson is a valuable addition to the erapeutic procedures for fractured mandibles. s use, however, is associated with certain risks hich preclude its employment by inexperienced erators.

healing has occurred, is often a formidable undertaking. In addition, unreduced fractures of the zygoma may result in visual disturbances, infection of paranasal sinuses and interference with proper occlusion of the teeth. In general, the authors advise immediate reduction before swelling appears, but if this is not possible, it is better to wait five or six days until the swelling subsides. Two methods of treatment afford the best results: 1. The temporal approach (described by Gillies) is excellent to elevate depressed fractures involving the arch provided the face of the maxillary sinus has not been depressed into the antrum. 2. The antral approach through the vestibule of the mouth is indicated to correct downward displacement of the floor of the orbit and displacement of bone fragments into the antrum.

66. Ivy, R. H., and Curtis, L.: Recent Experiences th Skeletal Fixation in Fractures of the Mandible, Oral Surg. **1**:296, 1943.

67. Waldron, C. W.; Kazanjian, V. H., and Parker, B.: Skeletal Fixation in the Treatment of Frac-es of the Mandible, J. Oral Surg. **1**:59 (Jan.) 1943.

68. Converse, J. M.: External Skeletal Fixation, J. al Surg. **1**:210 (July) 1943.

69. Thoma, K. H.: Y-Shaped Osteotomy for Correction of Open Bite in Adults, Surg., Gynec. & Obst. **77**:40 (July) 1943.

70. Coakley, W. A., and White, M. F.: Fractures of the Zygoma, Surg., Gynec. & Obst. **77**:360 (Oct.) 1943.

(Comment: Coakley and White give sound advice when they emphasize that adequate treatment for a fracture of the zygoma depends on the type of fracture. Obviously a fracture associated with downward and backward displacement of the orbital floor into the antrum cannot be corrected by the temporal approach. Sagging of the eyeball associated with double vision and infection of the maxillary sinus is apt to result from such inadequate treatment.

As stated by the authors, the best approach in these cases is through the vestibule of the mouth (as in the Caldwell-Luc operation), which permits removal of loose bone fragments and blood clot from the antrum and elevation of the depressed orbital floor into the normal position. The surgeon may then choose to fix the fractured bone by direct wiring, by packing from the floor of the antrum upward or by placing a wire around the fractured segment and bringing it out through a small incision in the skull to a head cap type of fixation. In all such cases an opening should be made into the antrum through the nose to provide free drainage.)

After discussing the indications for the uses of the osteoperiosteal bone graft, McBride [71] contributes a new method for applying the graft across the line of fracture. This technic consists of covering the osteoperiosteal graft by a flat vitallium plate which contains two screw openings at each end. Screws are inserted in these openings to extend downward through the bone graft into the underlying bone fragments. Tightening the screws squeezes the bone graft gently but firmly to its host bed on the bone fragments. Firm contact of the graft to its bed provides the necessary basis for plastic coalescence, just as compression by sponge pressure stabilizes the skin graft to create coherence.

Kazanjian [72] points out that even under wartime conditions a complete loss of most of the lower jaw and surrounding soft tissues is a rare injury. Early competent care consists of treating the patient for shock and maintaining an unobstructed airway. As soon as local conditions are favorable, temporary splints are adjusted to hold the remaining portions of the mandible in position. Two types of splints used for this purpose are described, and a surgical technic for repair of the soft tissue defect is given.

MISCELLANEA

The various metals used for buried appliances in the practice of surgery are discussed by Venable and Stuck.[73] They state that as modern surgery has developed, repeated efforts have been made to fashion metal appliances which could serve in the support of soft tissues, in the ligation of vessels and in the internal fixation of fractures. Brass, carbon steel, nickel-plated steel and many other metals and alloys give rise to irritation when buried in human tissues. This irritation is now known to be due to intense electrolytic reactions caused by the effects of the body fluids on the dissimilar metals contained in the alloy. Venable and his associates previously demonstrated that the extent of the damage of tissue was roughly equivalent to the amount of galvanic action which took place between the metals.

An essential of any metal that is to be buried in the body tissues is passivity or freedom from electroactivity in the body fluids. Only three materials generally available seem to possess sufficient passivity to be used safely in the body: "18-8-SMO" stainless steel, which is relatively inert and can be adapted for small appliances such as wire or screws; tantalum, which is inert and will be useful when production problems are solved, and vitallium, which is inert, has been used widely and has been found to be perfectly safe for any type of appliance except wire, which requires malleability and strength.

According to Large,[74] animal experiments show that alloy-steel metallic sutures give the minimal reaction with the maximum tensile strength in the wound. Cotton, silk (plain or waxed), plastigut, nylon and catgut produce reactions of increasing degrees in the order mentioned.

Haffly [75] reports that capillary blood obtained by deep needle puncture of the ear lobe from patients with hemophilia showed relatively normal coagulation time. The same patients' blood had a greatly prolonged coagulation time when tested by the Lee and White method, venous blood being used without admixture with the tissue juices. The author concludes that unless the familial or the personal history or the physical signs are suggestive of a bleeding diathesis, routine tests of the clotting mechanism of the blood are not indicated. If the familial or the personal history or the physical signs are suggestive of a bleeding diathesis, the following data are

71. McBride, E. D.: Plated Osteoperiosteal Graft, J. A. M. A. **121**:652 (Feb. 27) 1943.

72. Kazanjian, V. H.: Treatment of Extensive Loss of the Mandible and Its Surrounding Tissue, J. Oral Surg. **1**:30 (Jan.) 1943.

73. Venable, C. S., and Stuck, W. G.: A General Consideration of Metals for Buried Appliances in Surgery, Surg., Gynec. & Obst. **76**:297 (April) 1943.

74. Large, O. P.: A Comparison of Tissue Reactions from New Sutures, Am. J. Surg. **60**:415 (June) 1943.

75. Haffly, G. N.: Preoperative Detection of Bleeding Tendency in Patients with Otolaryngologic Disorders, Arch. Otolaryng. **37**:622 (May) 1943.

agnostic value: (1) the coagulation time of enous blood, (2) the bleeding time as deter-ined by the Duke method, (3) the type of clot etraction, (4) the capillary resistance as deter-ined by the Rumple-Leede test, (5) the platelet unt, (6) the prothrombin time.

In certain cases in which a bleeding diathesis noted, the results of all diagnostic blood tests ay be normal and yet the patient may suffer tal hemorrhage after a surgical procedure.

In the opinion of Byars [76] radiation treatment seldom successful in curing the port wine ariety of angioma. Adequate treatment consists complete excision and grafting of skin. Port ine stains in women may be covered by cos-etics, so there is no need of resorting to opera-ve removal of the growth. The venous angioma ay be excised or sclerosing solutions in-cted; the interstitial use of radon is sometimes neficial. The author recommends the inter-itial implantation of gold radon seeds for malig-nt arterial angioma when the growth cannot e completely excised. The interstitial use of adon is also indicated for the treatment of ar-rial angioma about the face, where complete cision of the growth would produce consider-le deformity.

In the treatment of 32 patients with melanoma the Brooklyn Cancer Institute the best results, reported by Howes and Birnkrant,[77] were tained by radical local removal. The authors ree, however, that this should be followed by dissection of regional lymph nodes whenever possible, but they advise against radiation therapy except as a palliative measure.

Wiss and Taylor [78] have developed a method of preserving nerve grafts by freezing them at —195 C. and later dehydrating and storing the nerves in sealed aseptic containers. The nerves were then rehydrated so that they resumed their normal appearance and were grafted into gaps in the nerves of the hindlimb in rats, cats and monkeys. The authors found that the homoplastic nerve grafts heal and promote regeneration much as do live grafts. In contrast, heteroplastic grafts (from one species to another) are unsuccessful, behaving much like foreign bodies.

The Council on Physical Therapy of the American Medical Association [79] declares that under properly controlled conditions the killing of air-borne micro-organisms by ultraviolet rays may be used to supplement other methods of disinfecting the air to prevent cross infection in wards for patients with contagious diseases and in nurseries and to reduce air-borne infection of wounds in operating rooms. Present evidence indicates that ultraviolet radiation is an uncertain means of sterilizing solid objects (drinking cups, combs, brushes, shaving utensils, toilet seats and shoes) even if irradiation of the whole surface is possible.

76. Byars, L. T.: The Malignant Hemangioma, rg., Gynec. & Obst. **77**:193 (Aug.) 1943.

77. Howes, W. E., and Birnkrant, M.: Melanoma, n. J. Surg. **60**:182 (May) 1943.

78. Wiss, P., and Taylor, A. C.: Dehydrated Nerve Grafts, Proc. Soc. Exper. Biol. & Med. **52**:326 (April) 1943.

79. Ultraviolet Lamps for Disinfecting Purposes, report of the Council on Physical Therapy, J. A. M. A. **123**:92 (Sept. 11) 1943.

Abstracts from Current Literature

Ear

A New Method for Treatment of Acute Aero-Otitis Media. Robert H. Wiseheart, Ann. Otol., Rhin. & Laryng. **52**:581 (Sept.) 1943.

The pharyngeal portion of the eustachian tube is appropriately called the "danger zone." In flying, during the ascent the atmospheric pressure of 760 mm. is "trapped" within the middle ear, while the barometric pressure is reduced, and at each few hundred feet of ascent the air within the middle ear expands to a point where the intratympanic pressure is sufficient to force the collapsed tube to open, allowing enough air to escape into the pharynx to equalize the pressure. When the excess pressure within the middle ear reaches approximately 15 mm. of mercury, the ear feels full and a "click" is heard as the ear drum snaps back into normal position on equalization of the pressures. Usually on ascent there is no particular discomfort, as the escape of air from the middle ear is accomplished rather readily. On descent, however, conditions are reversed: The middle ear must be consciously inflated by swallowing, yawning or the Valsalva method; this is called autoinflation. The process becomes more complex when there is an alteration in the nasopharyngeal portion of the eustachian tube brought about either by acute nasopharyngitis or by such conditions as exist in the case of a dive-bombing pilot. In acute nasopharyngitis there is congestion of the mucosa of the nasopharynx which will mechanically plug the opening of the eustachian tube, and autoinflation will be difficult or impossible. In dive-bombing the pressure on the eustachian orifice increases too quickly to permit the pilot to equalize pressures as he cannot swallow or yawn often enough to keep the tube open, and a deep-seated pain and varying degrees of conduction deafness develop in the ear.

Aero-otitis media has developed in pilots who have breathed pure oxygen while on prolonged flights at high altitude, particularly if the oxygen has been breathed until the flyer has returned to ground level. The condition usually appears about four to six hours after descent and probably results from absorption of the practically pure oxygen in the middle ear, resulting in decreased pressure. This may account for the cases of "delayed aero-otitis" seen in pilots after high altitude missions.

The usual treatment has been the use of vasoconstrictors and inflation, with application of warm oil vapors to the external canal. By accident an officer was treated by the Proetz displacement method and received immediate relief. Subsequently 127 men were so treated and the results compared with the results of the usual treatment. Those treated by displacement received relief sooner and returned to duty much sooner, in one to two days instead of the usual twelve days (average).

Technic.—1. The patient is placed in a reclining position, and a vasoconstrictor is introduced into each nostril (ephedrine sulfate 2 per cent or 2-aminoheptane sulfate (tuamine sulfate 1 per cent) in isotonic solution of sodium chloride) at the rate of 4 drops every two minutes until 20 drops have been used.

2. The patient is instructed to blow the nose gently.

3. With the head over the edge of the table or b so that the chin and the external meatus are perpe dicular to the floor, 3 cc. of 0.5 per cent ephedri sulfate or 1 per cent 2-aminoheptane sulfate in isoto solution of sodium chloride is slowly introduced i each nostril.

4. Negative pressure (approximately 180 mm. of me cury) is applied to each nostril while the other is clos with the finger and the patient says "Kay" or "cak The latter procedure is repeated for six fluctuations each nostril, and then the patient is allowed to sit ere

5. After ten minutes the instillation and suction a repeated. Usually during this procedure the patient w be able to open the ear at will.

6. The patient gently blows his nose, and then, as t patient swallows, positive pressure is produced with t same displacement bulb as in the Politzer method.

7. The patient is given a vasoconstrictor, usually amphetamine or a 2-aminoheptane sulfate inhaler, to u at intervals to keep the nasopharyngeal mucosa shru and the ear open. M. V. Miller, Philadelphia.

A Muted Megaphone for the Fitting of Hearing Aids. Walter Hughson and Eva Thompson, J. M. A. **124**:570 (Feb. 26) 1944.

Hughson and Thompson present a "muted" megaphone for use in the fitting of hearing aids, in an attem to provide a simple, accurate and inexpensive method measuring hearing loss for speech and the gain whi any hearing aid may give to the hard of hearing patie

They discuss in moderate detail the value of the co versational and the whispered voice for determini hearing impairment and the use of these in the fitti of hearing aids, emphasizing how inaccurate tests w the former can often be.

From here on they rationalize on the importance obtaining accurate control of the spoken voice so t by means of a damped or "muted" megaphone of a ce tain length and at a definite distance from the patie the examiner is able to determine with a reasonal degree of accuracy the improvement in hearing or t lack of it when any hearing aid is applied to the patie

The "muted" megaphone is simply a megaphone i which specially designed felt disks are placed, secur by two strips of tape placed lengthwise inside.

The voice is then "attenuated" (reduced), and t examiner can place himself at a definite distance fr the patient so that his voice will be constant and t improved hearing noted when a hearing aid is fitted

In due course, after further experimentation, t aurist will perfect a technic whereby he alone will the hearing aid to the patient instead of the engine or the high pressure salesman with no training in me cine, much less in otology, who unfortunately are do this work at the present time.

Gordon, Philadelphia.

Chronic Otorrhea Due to Food Sensitivity. Lou J. Noun, J. Allergy **14**:82 (Nov.) 1942.

The author reports the cases of 2 boys with chro otorrhea, which was relieved by the removal of offe ing foods from the diet. He stresses the importa of thinking of sensitivity of the drum membrane a

middle ear when chronic otorrhea is observed in tients with a family history of allergy and the recurnt attacks of discharge from the ears are featured an absence of fever.

HOVER, Cincinnati. [AM. J. DIS. CHILD.]

RAINING FOR THE OPTIMUM USE OF HEARING AIDS. S. RICHARD SILVERMAN, Laryngoscope **54**:29 (Jan.) 1944.

Most users of hearing aids complain that words are t clear or easily understood, although sound itself n be heard adequately.

The author presents cases to show that by systematic aining such difficulties can be at least partially overme. He feels that such training produces a cerebral orientation to speech transmitted through a hearing id.

Seven cases are presented. The patients had all worn aring aids regularly for more than a year. They had come thoroughly accustomed to the aids and did not pect to hear any better with their continued use. hey were tested before and after the training period r the perception of words and sentences.

The acoustic training is given in detail. Twenty lesns of an hour each were given over a period of ten eeks.

Six of the 7 patients showed improvement in the derstanding of speech. More cases should be studied confirm this, but Silverman's study at least suggests t those with hearing aids would be benefited by oustic training.

HITSCHLER, Philadelphia.

ÉNIÈRE'S SYNDROME—ITS MECHANISM AND MANAGEMENT. MILES ATKINSON, New York State J. Med. **44**:489 (March 1) 1944.

Attacks of paroxysmal vertigo associated with deafss and tinnitus make up the symptom complex comnly described as Ménière's disease. Atkinson says t "the mechanism is a vascular one." Either vasoation or vasoconstriction may bring on an attack. He s been using histamine as a method of "desensitizan" with good though somewhat slow results. Intraous injections are given at first, followed by intrascular ones, which eventually are administered by e patient himself, plus the swallowing of tablets by outh. But supervision by the physician must be intent. Atkinson reaches the following conclusions: Cases of Ménière's syndrome can be divided into two oups by means of intradermal tests for sensitivity to istamine. 2. These two groups have a varying physiogic mechanism, in the one primarily vasodilator, in e other primarily vasoconstrictor. 3. Treatment dapted to the physiologic mechanism in each group as proved reasonably successful. 4. Relief of vertigo least can be envisaged but is attained only by indiidual attention to the individual patient.

VOORHEES, New York.

Pharynx

FFECT OF TONSILLECTOMY ON RESPIRATORY INFECTIONS IN CHILDREN. ALBERT D. KAISER, Bull. New York Acad. Med. **18**:338 (May) 1942.

In this paper the term "respiratory infection" includes l of the symptoms primarily and secondarily referable the upper respiratory tract. Though children of all es may contract any of the infections of the respirary tract, all of these infections are most prevalent ong 3 to 7 year old children. In evaluating the effects of tonsillectomy, the author has taken into consideration all the factors which influence the development of infections of the respiratory tract.

The author stresses the fact that no scientific evidence is as yet available which explains the part that the tonsillar tissue plays in the economy of the child. Four thousand, four hundred children were followed for ten years. One-half this number had their tonsils and adenoids removed; the other half did not. The initial observation of these children began when they were between the ages of 4 and 7 years and continued into their high school period. At the time of their initial examination indications for tonsillectomy were numerous but in general the same for the entire group. For various reasons, one-half the total group submitted to the operation, so that the children who were not operated on served as controls.

Tonsillitis was a common complaint among the young children. Approximately 38 per cent of the entire group were subject to repeated attacks of tonsillitis during the first seven years of life. The incidence of sore throat was lessened during the ten year period, and among children receiving surgical treatment attacks of tonsillitis occurred with only a slight decrease in frequency during the same years. The author concludes that the common ailment named tonsillitis or sore throat occurred less frequently among the patients whose tonsils had been removed.

Common Cold.—Four colds or more a year per child occurred with about equal frequency in both groups. Forty-two per cent of the children were subject to this repeated infection up to the age of 7 years. Over the ten year period the children who had been operated on showed only a slight diminution in comparison with the children who had not had surgical treatment. But it is likely, the author states, that the removal of the adenoids benefited the younger children. As the children advanced in age the adenoid tissue retrograded, so that those who had not been operated on were likewise benefited. The trend, as far as frequent colds were concerned, was downward as the child progressed in age. There is insufficient evidence to show that the role of the tonsils is a significant one either in predisposing to the common cold or in preventing it.

Otitis Media.—Only purulent otitis media was considered in this study. Fifteen per cent of the children who were subsequently operated on had suffered from this disease before they were 5 to 7 years of age. In the control group 12 per cent were thus affected. During the three year period after removal of tonsils and adenoids the incidence of otitis media was considerably lower in the group that had received surgical treatment.

Cervical Adenitis.—Cervical adenitis is usually secondary to nasopharyngeal infection. In each group 15 per cent of the children had enlargement of the cervical glands before they were 5 to 7 years of age. During the three year period after tonsillectomy, the incidence of cervical adenitis among the children who were operated on was 5 per cent; among those not operated on the incidence was 14 per cent.

Sinusitis and Nasal Allergy.—Acute sinusitis and nasal allergy in children were, from this study, not favorably influenced by tonsillectomy.

Laryngitis.—Recurrent laryngitis was observed in 3 per cent of the children after the operation and in 5 per cent before the tonsillectomy.

Bronchitis and Bronchopneumonia.—Generally, tonsillectomy reduces the incidence of infections of the upper respiratory tract, but it does not tend to lower the number of infections of the lower respiratory tract.

JAHR, Omaha. [AM. J. DIS. CHILD.]

COMPLICATIONS OF TONSILLECTOMY. R. N. MISRA, J. Indian M. A. **12**:108 (Jan.) 1943.

Misra, reviewing 2,078 cases of tonsillectomy, records the postoperative complications and the number of cases in which each occurred as follows: hemorrhage, 23; bronchitis, 1; exacerbation of pulmonary tuberculosis, 2; pulmonary abscess, 1; otitis media, 2; hyperpyrexia which yielded to sulfonamide drugs, 4; atrophy of the uvula, 1; deep cervical phlegmon, 1; surgical emphysema, 1; acute rheumatism, 1; habitual dislocation of the jaw, 1. In this series of cases of tonsillectomy there were none in which cavernous sinus thrombosis, abscess of the brain or glottic spasm followed operation.

GONCE, Madison, Wis. [AM. J. DIS. CHILD.]

Larynx

BRONCHOGRAPHY IN CHILDREN. C. ELAINE FIELD, Lancet **2**:357 (Sept. 26) 1942.

A new technic of bronchography of children is described in which they are anesthetized with nitrous oxide, while a special intratracheal needle is introduced through the cricothyroid membrane. During the injection of the iodized oil no anesthetic is administered, since the best bronchograms are obtained when the patient is fully consicous.

This method is suitable for children 5 years of age and over. For infants under 5 years the less satisfactory method with open ether anesthesia is used.

LANGMANN, New York. [AM. J. DIS. CHILD.]

STAPHYLOCOCCIC LARYNGOTRACHEOBRONCHITIS. ANT. LEÃO VELOSO and E. CORRÊA DE AZEVEDO, Arch. de pediat. **14**:469 (Sept.) 1942.

A case of acute laryngotracheobronchitis complicated with abscess of the lung is reported. The patient was treated first with antidiphtheritic serum, then with sulfanilamide, sulfathiazole, sulfapyridine and staphylococcic antitoxin and finally by tracheotomy and aspiration. Total recovery came after four months of treatment.

LOZOYA S., Mexico, Mexico. [AM. J. DIS. CHILD.]

CANCER OF THE LARYNX. ERNESTO RAFFO, Rev. de cir. **1**:47, 1943.

Raffo presents 2 cases of laryngeal cancer treated by total laryngectomy. One cure resulted.

He stresses two phases of this subject—early diagnosis and proper indications for operation. When there is a history of persistent hoarseness and a tumor is found situated in the anterior two thirds of the vocal cords, usually unilateral, one must suspect a cancerous process. The mass may be infiltrative, vegetative, circumscribed, papillomatous or even ulcerative. In addition there is limitation of the excursions of the vocal cords. This, however, may be a late symptom. A biopsy is indicated, and if it demonstrates no cancer cells, it should be repeated. Late symptoms of cancer include dyspnea, aphonia, painful reflexes both localized and radiating, and finally difficulty in swallowing.

Raffo also distinguishes between intrinsic and extrinsic cancer. The former involves the vocal cords, the ventricle or the subglottic region. The extrinsic form is usually inoperable and is best treated by irradiation. An intrinsic cancer limited to the anterior two thirds of the vocal cords is best treated by laryngofissure. The more advanced cancer requires total laryngectomy. Finally, if metastasis has occurred, irradiation is indicated.

PERSKY, Philadelphia.

Nose

CHRONIC VASOMOTOR RHINITIS: A CLINICAL INVESTIGATION OF ITS TREATMENT WITH A SCLEROSING AGENT. SAMUEL L. FOX, Laryngoscope **53**:7 (Dec.) 1943.

The author deals with chronic nasal obstruction caused by turgescence of the turbinal tissues, not obstruction due to structural defects. He calls the condition "chronic vasomotor rhinitis."

The condition is usually allergic, but sometimes glandular, sometimes nervous, sometimes due to sudden changes of temperature.

Constrictive drugs work well in the first stages but must not be used too frequently or too long. Eventually the smooth muscle will become paralyzed.

As the condition progresses the mucosa becomes waterlogged and polypoid, and mulberry-like hypertrophies occur on the posterior ends of the turbinates. Later there is true bony hypertrophy of the turbinates.

Treatment by means of caustics which destroy the mucous membranes is to be avoided. Actual cauterization, if done properly in selected cases, is of benefit. Diathermy has not given the desired results. Zinc ionization is dangerous.

Recently, sclerosing agents have been injected submucosally. The author has used sodium psylliate solution (sylnasol) in more than 200 cases with excellent results. Less than 10 per cent of his most recent patients with this condition have failed to benefit. Note that only the turbinates which shrink well with a sympatheticogenic spray are suitable for treatment.

The technic of the injection is described. Only minor discomfort is usually observed with the treatment. Actual shrinkage can be seen in from seven to ten days.

HITSCHLER, Philadelphia.

NASOALVEOLAR CYSTS. FRANCIS A. SOOY, Laryngoscope **54**:18 (Jan.) 1944.

There have been few cases of nasoalveolar cysts reported in American literature even though the condition is reputed to occur once in every thousand persons.

The anomaly is most likely ascribed etiologically to embryologic epithelial rests of the facial cleft area.

Five cases are presented. The patients were middle-aged women, as were most of the patients whose cases had been reported previously. The chief complaint was nasal obstruction of varying degrees. Four of the patients noticed fulness beneath the nasal ala and obliteration of the nasolabial fold.

The cyst appears as a smooth, round, fluctuant swelling covered with mucosa. It protrudes under the anterior end of the inferior turbinate at about the mucocutaneous junction. The inferior turbinate is often displayed medially by the cyst.

The treatment is surgical removal, the incision being similar to that used in the Caldwell-Luc operation. In most cases blunt dissection of the cyst was all that was necessary, but in some cases a section of the nasal mucosa had to be excised also. No bone needed to be removed.

The microscopic section usually shows a columnar or cuboidal type of epithelium with mucus-secreting cells.

In the differential diagnosis, three conditions must be nsidered. They are: (1) dental root cyst, (2) den-gerous cyst and (3) globulomaxillary cyst. These are cussed in detail. HITSCHLER, Philadelphia.

mo-CYCLITIS AND CHOROIDITIS DUE TO "SILENT" SINUSITIS. R. FORD, Brit. J. Ophth. **27**:469 (Oct.) 1943.

The author cites the histories of 2 patients to show w elusive, even with every advantage for expert diag-sis, the cause of uveitis may be; she also gives the stories of 3 other patients to demonstrate that elimina-n of a focus of infection in the sinuses, even when re is no evidence of its existence other than the eitis, may lead to prompt and permanent cure. She ncludes that if all investigations give negative results a case of uveitis, latent sinusitis should be suspected d treated.

ZENTMAYER, Philadelphia. [ARCH. OPHTH.]

Miscellaneous

XPERIMENTAL STUDIES ON HEADACHE. E. KUNKLE, B. RAY and H. WOLFF, Arch. Neurol. & Psychiat. **49**:323 (March) 1943.

The authors infer that headache following drainage cerebrospinal fluid is caused primarily by traction on rious pain-sensitive structures which anchor the brain the cranium. Dilatation of some of these structures l of the intracranial veins and increase in brain lume are suggested as joint factors in the augmented ction which follows drainage of fluid and leads to adache.

The headache so often associated with increased intra-nial pressure has generally been assumed but never wed to be related to the increased pressure. Yet) elevation of intracranial pressure in normal human bjects to abnormally high levels failed to cause head-he; (*b*) in a series of 72 patients with tumor of the in headache occurred almost as frequently with nor-l as with increased pressure, and (*c*) headache homo-teral to the lesion in a patient with a tumor of the in was induced by lowering the intracranial pressure t could not be induced by elevation of the pressure to high level of 5.5 mm.

Hence increased intracranial pressure is neither a ne nor an essential factor in the production of head-he.

From these data it is concluded that the headache sociated with either decreased or increased intracranial ssure results from traction on or displacement of n-sensitive intracranial structures and is independent generalized changes in intracranial pressure.

IRVINE, Los Angeles. [ARCH. OPHTH.]

EECH DISORDERS AND THEIR TREATMENT. STANLEY COBB, Bull. New York Acad. Med. **19**:34 (Jan.) 1943.

Unlike other vertebrates, which specialize and reach rrow superiority by unique development of one type sense organ, man depends on a leading hemisphere nly developed in the reception and the elaboration all types of sensory impressions. Language is a oduct of this phenomenon and is made possible rough it.

In the central nervous system of man speech is in-grated at five important levels. These are not exact d there may be overlapping, but the division is sig-icant enough for practical purposes.

Level I is represented by the neuron from a nucleus the medulla oblongata (seventh, tenth or twelfth) to a peripheral organ of speech—lips, tongue or larynx. Through this level all nerve impulses concerned with speech must pass.

Level II is represented by the neuron arising from the motor cortex and ending in the medulla oblongata around the bulbar nuclei, its fibers passing down the corona radiata and through the internal capsule to the peduncles and the medulla. This, too, is a common pathway for all complex speech integrations of the higher levels.

Level III runs up from the medulla oblongata to the cerebellar cortex, then to the cerebellar efferent nuclei and upward to the midbrain, the thalamus and the motor cortex. Thus is supplied the mechanism of co-ordination necessary to the control of speech. These three levels may be considered together as a motor mechanism.

Level IV is in the Broca area. It involves symbolization and meaning. This is the "leading hemisphere," usually on the left.

Level V is the most highly integrated. It is associated with the great association area of the frontal and the parietal lobes. It involves memories, individual life experiences, impact of one person on another and emotional and social reactions influenced by all factors which make up the character and the personality of the individual.

The author presents a practical working explanation of the functional result of damage, physical or psychologic, to these particular levels. The various types of dysphasia and aphasia are discussed, with clinical emphasis on their significance, and the mode of therapy suitable to each syndrome. The article is well illustrated.

JAHR, Omaha. [AM. J. DIS. CHILD.]

FATALITIES AND CONSTITUTIONAL REACTIONS FOLLOWING THE USE OF PONTOCAINE [TETRACAINE HYDROCHLORIDE]. J. WARRICK THOMAS and MERYL M. FENTON, J. Allergy **14**:145 (Jan.) 1943.

Thomas and Fenton review the question of sensitivity to tetracaine hydrochloride as characterized by constitutional reactions occurring when this drug was used as an anesthetic during bronchoscopy, gastroscopy and dental extraction and in ophthalmologic practice. There have been at least three fatalities. It is important to bear in mind the possibility of such sensitivity when the use of tetracaine hydrochloride is contemplated for an allergic person. A patch test may aid in determining sensitivity.

HOYER, Cincinnati. [AM. J. DIS. CHILD.]

MODE OF ACTION OF GRAMICIDIN AND PENICILLIN IN THE TREATMENT OF INFECTIONS. CHARLES H. RAMMELKAMP, J. Bact. **45**:66 (Jan.) 1943.

Some of the characteristics of gramicidin and penicillin are described by the author. He states that these preparations are effective in vitro against gram-positive organisms. Gramicidin and tyrocidin are insoluble in body fluids and are toxic for all tissues. Therefore, according to the author, they should be used only for the treatment of localized infections. Penicillin, in contrast to gramicidin, is soluble in body fluids and is relatively nontoxic. It can be used in the treatment of generalized infections. Considerable difficulty is encountered when it is so used, because penicillin is excreted rapidly in the urine and a significant amount is "destroyed" in the body. Parenteral administration of penicillin is followed by such poor diffusion that a high concentration of the drug in the

blood at the site of the infection frequently cannot be obtained. However, as soon as the concentration is sufficient an antibacterial effect is produced. Phagocytosis is not the nature of the action against the bacteria. Up to the present time nothing has been found in the body which inhibitis the action of penicillin.

STOESSER, Minneapolis. [AM. J. DIS. CHILD.]

TRAUMATIC FACIAL PARALYSIS. VINCENTE MEDINA A., Bol. de otorrinolaringo. **2**:8, 1943.

Medina presents a case of fracture of the skull in which eight days after the accident paralysis of the facial nerve developed. Simple mastoidectomy was performed, and a fragment of bone was found pressing on the facial nerve. This was removed, and the patient made an uneventful recovery with a complete return of the function of the nerve. PERSKY, Philadelphia.

VERTIGO. JOHN A. MALCOLM, Laryngoscope **53**:755 (Dec.) 1943.

True vertigo has to do with a sense of rotation. A careful history must be taken in order to determine whether this is the sensation, for the patient may complain of vertigo when he really means faintness, giddiness and the like.

There may be secondary symptoms, such as nausea and vomiting. The presence of these helps in determining the severity of the condition.

Equilibrium is maintained by stimuli from the eyes, the muscles, the joints and the labyrinth, all in harmony. Vertigo, on the other hand, arises when one or more of such stimuli conflicts with or is out of harmony with the rest. Keeping this in mind makes the study of the causes of vertigo more easily understood.

Conflicting stimuli, hence vertigo, may be due to many lesions, which the author lists in detail. Briefly, these may be lesions affecting the eighth nerve, the cerebellum, the cerebrum, the brain stem, the spinal tracts, the blood vessels or the eyes. HITSCHLER, Philadelphia.

AN EPIDEMIC IN CHILDREN, CHARACTERIZED BY DIVERSITY OF LESIONS IN SKIN AND MUCOUS MEMBRANES, PROBABLY CAUSED BY STREPTOCOCCUS PYOGENES. P. B. MUMFORD and A. G. HEPPLESTON, Brit. J. Dermat. **55**:143 (June) 1943.

Mumford and Heppleston describe a nonfatal epidemic infection affecting all of 27 children, aged 2½ to 5 years, in a colony of evacuees and several members of the adult staff. It persisted with remissions for more than six months.

About half the children had inflammatory lesions of the nose, eyes, mouth and skin. Six were confined to bed and isolated with pyrexia and eruptions of varying severity. The matron had a sore throat. The nursing sister in charge of the children had a papulovesicular eruption of the extensor aspects of the limbs, without effect on her general health.

The distribution and appearance of the lesions in the children suggested first an external irritant. Exposed areas of skin and mucous membranes were involved; the effects of constant scratching and rubbing were obvious, and constitutional disturbance was considered to be the result of secondary infection. Extensive patch tests with a rare type of grass with which the children's playground had been sown were made on the children with the worst eruptions, but all tests proved negative. Within a few weeks many more children were affected, and several were toxemic, with high temperature, rigor and prostration. As most of the colony were becoming involved and the epidemic was growing out of control, bacteriologic investigations were undertaken. A high proportion of patients were found to be harboring hemolytic streptococci of group A type 4. Therapy with sulfonamide compounds was introduced. Rapid amelioration of general and local symptoms followed, but every "cured" patient had a relapse on fresh contact with other children.

BLUEFARB, Chicago. [ARCH. DERMAT. & SYPH.]

Book Reviews

Deafness and the Deaf in the United States, Considered Primarily in Relation to Those Sometimes More or Less Erroneously Known as Deaf-Mutes. By Harry Best. Pp. 675. Price $6.50. New York: The Macmillan Company, 1943.

This laborious work, a compilation of data on deafness, covers the topics "Causes," "Heredity," "Race," "Nativity," "Physical, Mental and Marital Conditions of the Deaf," "Legal Treatment," "Education," "Economic Condition," "Organization" and "Costs." The author, whose experience in the field is of long standing, has well nigh exhausted the factual side of the subject. It is regrettable, however, to wade through a book so full of statistics without finding a wealth of conclusions and recommendations that might be made. Without these the figures seem useless. Mr. Best feels that "we have no reason for disquiet" on the subject of intermarriage of deaf persons (a tender subject with deaf people); yet his figures show that the proportion of deaf children born to deaf parents is "only a little more than twice as great" as the proportion of deaf children born to normally hearing parents. It would seem that "twice as many" is quite enough!

Mr. Best in presenting the "Extent of Present Measures Dealing with Adventitious Deafness" expresses a regrettably hopeless attitude but admits that "a very large part of this deafness is preventable under enlightened action." "Medical science is principally in control of the situation." Fortunately, he does not expand on this subject, nor does he criticize the profession for past lapses in organized medical efforts.

One who is familiar with the looseness of the compilation of some mass statistics will question the exactness of some of the percentages and proportions set down. As an example, it is difficult, if not impossible, to state the incidence of deafness after the infectious fevers of childhood, yet Mr. Best's statistics for 21 per cent of 20,000 children in schools for the deaf are as follows: meningitis, 14.5 per cent; scarlet fever, 7.3 per cent; measles, 5.7 per cent; falls or blows, 5.4 per cent; whooping cough, 4.7 per cent; purulent otitis media, 4.1 per cent; pneumonia, 3.7 per cent.

The work is the most authoritative, complete and up-to-date book on the subject.

Medical Physics. Editor in chief, Otto Glasser, Ph.D., head of the department of biophysics of the Cleveland Clinic Foundation; professor of biophysics at the Frank E. Bunts Educational Institute; consulting biophysicist to the University Hospitals, Cleveland. Pages 1,744, with 1,300 illustrations. Price $18, postpaid. Chicago: The Year Book Publishers, Inc., 1944.

A distinguished biophysicist, together with a well chosen group of first class contributors in the various fields of medicine, surgery and the specialties, endeavors in this textbook to bring down to date the phases of physics related to medicine as these are encountered in current problems of medical practice. The book consists of 1,744 pages and over 1,300 illustrations, with a subject index that is detailed and revealing, further implemented with a name index.

The material covered is so wide and diverse that no reviewer could possibly give sufficient thought and reflection to the numerous subjects under discussion, but from the point of view of otolaryngology it is fitting to state that several otolaryngologic subjects are splendidly presented.

The contribution entitled "Audiometers and Hearing Aids," by Dr. Scott N. Reger, is deserving of high praise, and the otologist who will read this chapter with care will profit much thereby. "Bronchial Obstruction: Mechanism, Bronchoscopy, Esophagoscopy and Gastroscopy" and "Larynx Mechanism" are presented as only the Jacksons can present them. Electrosurgery is well considered by Dr. W. H. Schmidt. Vestibular mechanisms are thoroughly considered from every angle by Drs. E. A. Spiegel and I. Sommer. The subject of shock is handled in a masterly manner by the distinguished Dr. Virgil H. Moon.

There is a table of contents arranged in alphabetical order, after which a classified table of contents appears, also in alphabetical order.

Numerous references appear after every article in the text.

Office Treatment of the Nose, Throat and Ear. Abraham R. Hollender, M.Sc., M.D., associate professor of laryngology, rhinology and otology, University of Illinois College of Medicine. Pages 480. Price $5, postpaid. Chicago: The Year Book Publishers, Inc., 1944.

The author presents a well written textbook. He has drawn his material from the works of outstanding otolaryngologists. There is a complete general and author index.

Nearly every phase of the conservative treatment of the inflammations and infections, specific and nonspecific, of the external nose, the sinuses, the pharynx, the larynx, the external ear, the middle ear and the eustachian tubes is thoroughly considered, and the text matter is implemented with figures and diagrams.

Whenever controversial opinions arise, the author has wisely presented every side of the discussion, so that each reader can judge for himself which practice he believes is best in any given case.

Among the fine discussions that have appealed to the reviewer are the following: "Nutritional Management" (13 pages), "Office Surgery" (14 pages), "Nasal Allergy" (17 pages), "Disease of the Eustachian Tubes" (19 pages) and "Otosclerosis" (7 pages).

News and Comment

DIRECTORY OF MEDICAL SPECIALISTS

The third edition of the Directory of Medical Specialists, listing names and biographic data of all physicians certified by the fifteen American Boards, is to be published early in 1945. Certified specialists are requested to make prompt return of the notices regarding their biographies as soon as possible after receiving the proper forms, soon to be mailed from the publication office.

Directory of Otolaryngologic Societies *

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Louis H. Clerf, 1530 Locust St., Philadelphia.

Secretary: Dr. Fletcher D. Woodward, 104 E. Market St., Charlottesville, Va.

American Academy of Ophthalmology and Otolaryngology

President: Dr. Lawrence T. Post, 508 N. Grand Blvd., St. Louis, Mo.

President-Elect: Dr. Gordon B. New, Mayo Clinic, Rochester, Minn.

Executive Secretary: Dr. William L. Benedict, Mayo Clinic, Rochester, Minn.

Place: Palmer House, Chicago. Time: Oct. 8-11, 1944.

American Broncho-Esophagological Association

President: Dr. Robert L. Moorhead, 125 Ramsen St., Brooklyn.

Secretary: Dr. Paul Holinger, 700 N. Michigan Ave., Chicago.

Place: New York. Time: June 6, 1944.

American Laryngological Association

President: Dr. Charles J. Imperatori, 108 E. 38th St., New York.

Secretary: Dr. Arthur W. Proetz, Beaumont Bldg., St. Louis.

Place: New York. Time: June 7-8, 1944.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Albert C. Furstenberg, University Hospital, Ann Arbor, Mich.

Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.

SECTIONS:

Eastern.—Chairman: Dr. Oram R. Kline, 414 Cooper St., Camden, N. J.

Southern.—Chairman: Dr. Verling K. Hart, 106 W. 7th St., Charlotte, N. C.

Middle.—Chairman: Dr. Carl H. McCaskey, 608 Guaranty Bldg., Indianapolis, Ind.

Western.—Chairman: Dr. Aubrey G. Rawlins, 384 Post St., San Francisco.

American Otological Society

President: Dr. Wesley C. Bowers, 17 E. 61st St., New York 21.

Secretary: Dr. Isidore Friesner, 101 E. 73d St., New York.

Place: New York. Time: June 5-6, 1944.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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